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United States
Department of
Agriculture

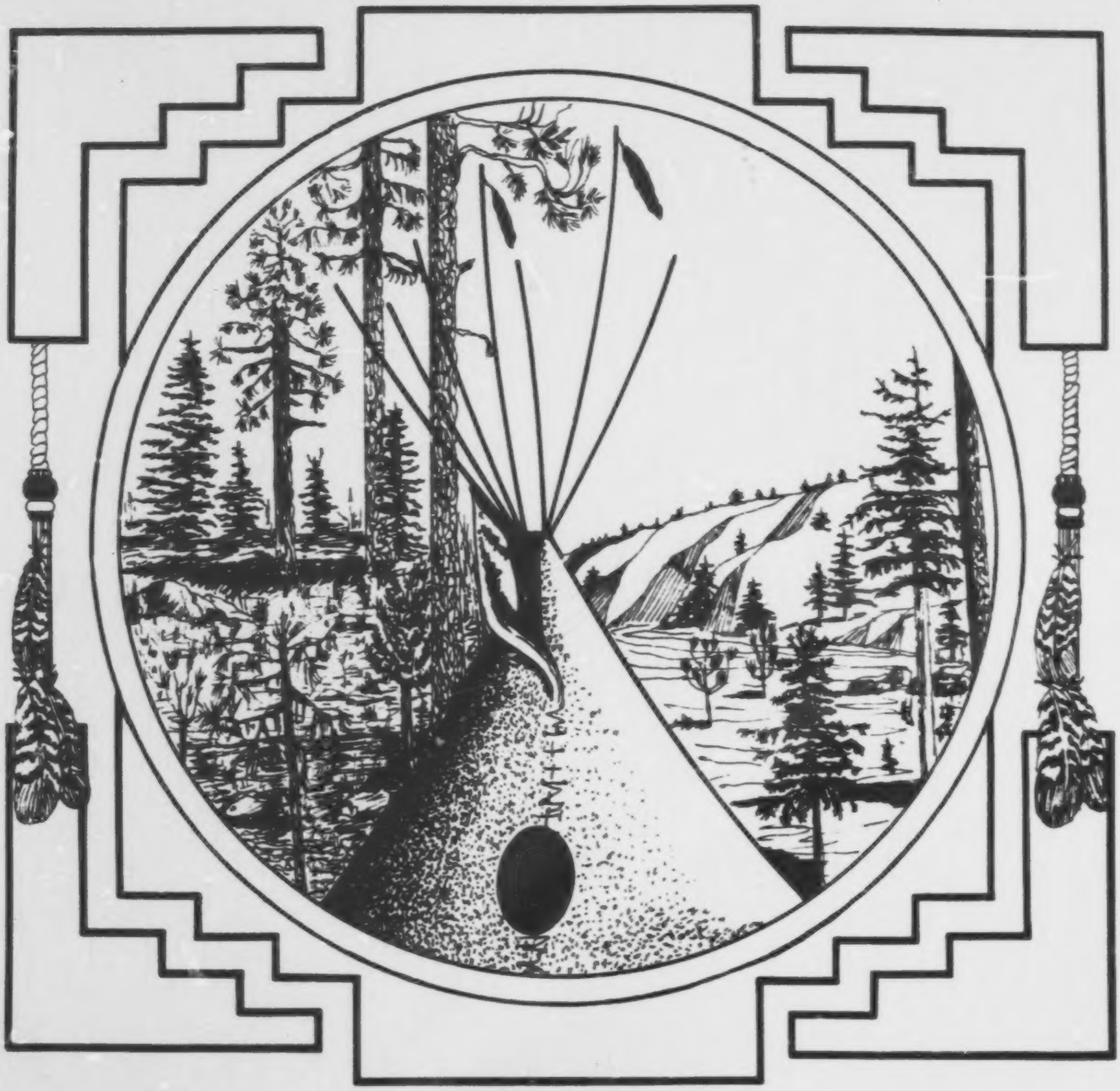
Forest Service

**Pacific
Northwest
Region**

Tepee Butte Recovery Project

Draft Environmental Impact Statement

Hells Canyon National Recreation Area
Wallowa-Whitman National Forest



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DRAFT ENVIRONMENTAL IMPACT STATEMENT

TEPEE BUTTE FIRE RECOVERY PROJECT
WALLOWA-WHITMAN NATIONAL FOREST

Wallowa County, Oregon

April 1989

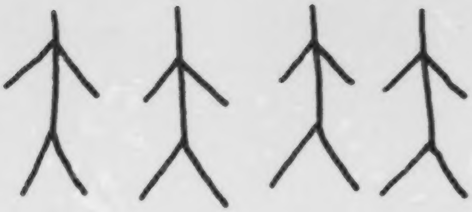
Lead Agency:	USDA Forest Service
Responsible Official:	Robert M. Richmond Forest Supervisor Wallowa-Whitman National Forest P.O. Box 907 Baker, Oregon 97814
For Further Information, Contact:	Steven Howes Project Director Gail Aschenbrenner Public Information Officer P.O. Box 907 Baker, Oregon 97814 Phone (503) 523-9401

ABSTRACT

The Wallowa-Whitman National Forest has developed five alternatives for managing the 60,000 acre Tepee Butte Fire Recovery Project area. This portion of the Forest is in Hells Canyon National Recreation Area and burned during the August-September 1988 Tepee Butte Fire.

Each alternative is consistent with management direction provided in the Hells Canyon National Recreation Area (NRA) Comprehensive Management Plan (CMP), and responds differently to major issues and concerns identified during the planning process. Alternative A, the "No Action" alternative, would allow resource recovery over time through natural processes. Rehabilitation of elk cover and other wildlife habitat is the theme of Alternative H, while recovering other resource values to a moderate degree. Recovering and enhancing the recreation and visual resources is the focus of Alternative I, with treatments conforming to the desired physical and social settings described in the CMP. Alternative J blends intermediate levels of recovery and enhancement of the affected resources; salvage harvest of damaged timber is proposed where it complements wildlife, visual, and recreation resources. Alternative G, the Preferred Alternative, emphasizes vegetation management and wildlife habitat recovery by managing for healthy and diverse timber stands over time, maintaining big game cover that survived the fire, and re-establishing cover that was destroyed. This alternative would salvage 30.7 MMBF of merchantable timber, with 3.5 MMBF optional timber sale volume.

Comments on this draft must be received by the Forest Supervisor, P.O. Box 907, Baker, Oregon 97814, by **June 19, 1989**.



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LIST OF PREPARERS

LIST of AGENCIES, ORGANIZATIONS, and PERSONS to WHOM COPIES of the STATEMENT WERE SENT

LITERATURE CITED

GLOSSARY

APPENDICES

A - Rate of Deterioration
B - Watershed and Fisheries Environmental Effects
C - Visual Resource Cumulative Effects
D - Best Management Practices
E - Entomology Report
F - Species List
G - Economic Analysis - Models and Methods
H - Resource Projects
I - Cultural Resource - Laws, Regulations, and SHPO
J - Vegetation Management
K - Road Management Plan
L - Description of Rock Types

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CREDITS FOR PHOTOGRAPHS AND ARTWORK

Page Number	Credit	
I-3	J. Hughes	Forest Service
I-9	C. Johnson, Jr.	Forest Service
I-13	M. Bantam	Forest Service
II-4	M. Bantam	Forest Service
II-15	R. Swart	Wallowa County Chieftain
II-33	J. Hughes	Forest Service
III-2	M. Bantam	Forest Service
III-9	J. Hughes	Forest Service
III-12	M. Bantam	Forest Service
III-15	J. Hughes	Forest Service
III-30	J. Hughes	Forest Service
III-32	R. Miller	Forest Service
III-39	J. Hughes	Forest Service
III-45	J. Hughes	Forest Service
III-54	R. Steed	Forest Service
III-60	J. Hughes	Forest Service
III-61	J. Hughes	Forest Service
III-63	M. Bantam	Forest Service
IV-3	M. Bantam	Forest Service
IV-5	J. Hughes	Forest Service
IV-30	J. Hughes	Forest Service

The illustrations for section dividers are taken from ancient pictographs and petroglyphs found within the Hells Canyon NRA. Dating back hundreds and in some cases, thousands of years, the rock art is thought to symbolize events and beliefs in the lives of the ancestral Nez Perce Indians.

Cover design by Hays Outdoor Signs, Enterprise, Oregon, and Pat Hinton, Forest Service.

LIST OF REFERENCED DOCUMENTS AVAILABLE FOR PUBLIC REVIEW

Documents available for review:

EDAW, Inc. 1978. *Hells Canyon NRA Visual Resource Inventory and Imnaha Valley Study.* Contract report prepared for Wallowa-Whitman National Forest by EDAW, Inc. San Francisco, CA. Available at WWNFHQ and HCNRA.

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USDA *Forest Service Manual* 2672.42a February 24 1988, Washington Office Ammendment Proposed, Endangered, Threatened and Category Species Occurrence for Land Administrated by National Forest Service. Includes the following Revised February 1988 Lists:

USFS Threatened, Endangered and Sensitive Mammals List.
USFS Threatened, Endangered and Sensitive Bird List.
USFS Sensitive Amphibian and Reptile List.
USFS Region 6 Sensitive Plant List.
USFS Region 6 Sensitive Fish List.

Available at PNWRHQ, WWNFHQ AND HCNRA.

USDA Forest Service, Fall 1988, Order III Soil Survey, Wallowa-Whitman National Forest. Unpublished, available at Soils Laboratory, Baker Ranger District Office, Baker, Oregon.

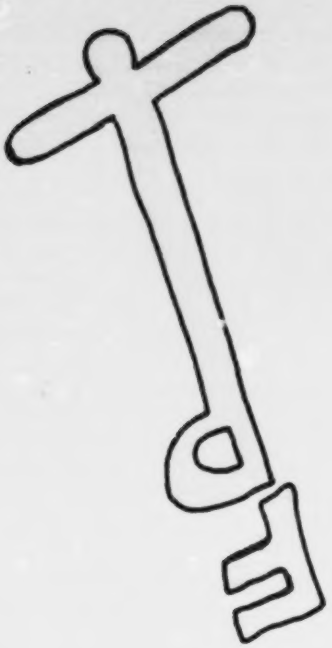
USDA Forest Service Road Log and Inventory for the Hells Canyon NRA. Updated annually, unpublished, on file at North Engineering Zone, Wallowa Valley Portion, Wallowa Valley District Office, Joseph, Oregon.

Locations where documents are available:

PNWRHQ - USDA Forest Service, Pacific Northwest Regional Headquarters, Portland, Oregon.

WWNFHQ - Wallowa-Whitman National Forest Headquarters, Baker, Oregon.

HCNRA - Hells Canyon National Recreation Area Office, Enterprise, Oregon.



SUMMARY

SUMMARY

INTRODUCTION

This is a general summary of the Draft Environmental Impact Statement (DEIS) for the the Tepee Butte Recovery Project. The Tepee Butte Fire burned through approximately 54,100 acres of the Hells Canyon National Recreation Area (NRA) on the Wallowa-Whitman National Forest between August 25 and September 9, 1988. Resources on nearly 6,000 acres of private lands were also affected by the fire. This summary discusses a range of alternative responses to conditions in the project area.

Five alternative strategies for recovery of resources and management of lands within the project area are presented for public review and comment. After a 45-day review period, a Final Environmental Impact Statement (FEIS) will be prepared. That document will respond to public comments and provide the decisionmaker with other relevant information which is essential for sound management of the project area.

In the pages of the Draft EIS, the purpose and need for an Environmental Impact Statement are explained; issues dealing with the future of this land are discussed; and the project area is described. Five alternatives for recovery of the area are then displayed and the different ways they respond to the issues are explored. A comparison of alternatives discloses many important environmental consequences of the fire and of proposed management activities.

Copies of this Draft EIS may be obtained from the Tepee Butte Recovery Project, Wallowa-Whitman National Forest, PO Box 907, Baker, Oregon 97814 (503-523-6391).

PURPOSE AND NEED

The National Environmental Policy Act of 1969 (NEPA) requires preparation of an Environmental Impact Statement when a major Federal action may significantly affect the quality of the human environment. A history of controversy and a high level of public interest in the area affected by the Tepee Butte Fire have led officials to determine that recovery activities on lands within the Hells Canyon NRA would constitute a significant Federal action.

The purpose of this document is to present a full and fair discussion of the environmental impacts of proposed recovery activities in the area.

ISSUES

Public comment on the future management of the Tepee Butte Fire Recovery area began in November when the Wallowa-Whitman National Forest Supervisor solicited public comment with a general mailer, in newspaper ads, and in four public scoping meetings. Meetings with environmental groups, local, State, and Federal officials, and representatives of the timber industry were also held.

From the hundreds of opinions voiced and from written comments received, nine major issues emerged. They are summarized below:

Issue No. 1 - Recreation Resources

The project area provides recreation opportunities that depend on a predominantly natural or natural appearing environment. Retaining opportunities for quality recreation and limiting alteration of the natural setting are of primary concern.

Issue No. 2 - Visual Resource

The project area provides ample opportunities for viewing scenic attributes of the natural environment, a major reason for public visits to Hells Canyon NRA. Preserving scenic values is a primary concern.

Issue No. 3 - Water Quality/Fisheries

Clean, cool water is required to support a healthy population of resident and steelhead trout. Loss of vegetation on hillsides and in riparian areas will result in increased sediment entering streams, increased stream temperatures and peakflows, and a loss of organic input to stream systems. Road construction, timber harvest, and livestock grazing can further aggravate these impacts on water quality.

Issue No. 4 - Wildlife Habitat

Changes in wildlife habitat resulting from the fire may be compounded by recovery activities. The fire has diminished thermal and hiding cover, as well as other vegetation, which are essential for big game and other wildlife species.

Issue No. 5 - Long-Term Site Productivity

Long-term productivity depends on maintenance of the natural, physical, and chemical properties of the soil through continued deposition of organic matter and associated nutrients to the soil/vegetative system. There is concern that the fire has severely impacted long-term site productivity by removing woody debris, litter, and organic matter and by exposing soils to erosion.

Issue No. 6 - Vegetation Management

The fire has had both immediate and long-term effects on vegetation and timber stands. The immediate effect is a change in stand structure and species composition. There will be subsequent changes in successional patterns which result from tree mortality and associated effects on water yield, forage production, wildlife habitat, and future fire hazards. Both the immediate and long-term effects will vary, depending on whether dead timber is harvested or not, whether artificial or natural regeneration takes place, and whether or not exotic grasses are introduced. There is concern about the amount of reforestation that would be provided and whether it would be by natural or artificial means.

Issue No. 7 - Transportation System

The public have concerns about the extent of new road construction that would be necessary to support recovery activities. Some believe that maximum road access should be provided to support timber recovery and increase recreational access to the area. Others believe no new road construction should be allowed.

Issue No. 8 - Rapid Timber Recovery

The project area contains large amounts of fire-killed and severely damaged softwood timber. Affected timber begins to deteriorate as soon as it is dead. Weathering, insects, and decay of fire-killed or severely damaged timber causes a rapid depreciation in sound volume and selling value.

Issue No. 9 - Economics

Any management activity conducted in the project area would have an economic impact on both local and State economies. Depending on the scope and range of activities, a significant change in local employment levels and income could result. Salvage of fire-killed and damaged timber has the potential of causing the largest single economic impact. Through scoping and continued public involvement in developing viable management alternatives, a concern for the economic viability of salvaging timber and rehabilitating affected resources was identified. Economic analyses are included in the Draft EIS.

AFFECTED ENVIRONMENT

The Tepee Butte Recovery Project area is in the northernmost portion of the Hells Canyon NRA. It is located in Wallowa County in northeastern Oregon. The area is characterized by broad, flat ridgetops and steep, incised canyons. Elevations range from 900 feet above sea level at the Snake River, the eastern boundary of the project area, to 5,300 feet at Buckhorn Lookout.

Annual precipitation ranges from 10 to 25 inches, mostly occurring during winter months as snow. Summer thunderstorms often produce heavy rain.

Rocky Mountain elk, mule deer, and black bear are found within the project area. Resident fish are found in Cottonwood, Cook, and Cherry Creek drainages. Of these three, only Cottonwood Creek supports anadromous fish.

Douglas-fir and grand fir are the most common overstory tree species in the project area. Other species include ponderosa pine, lodgepole pine, Engelmann spruce, and western larch. A large portion of the project area is composed of non-forested grasslands.

Since the project area is within an NRA, recreational use is an important consideration. The area is generally unroaded. Steep canyon topography and a variety of vegetation patterns provide scenic views that are unparalleled.

THE FIRE

Approximately 52 percent of the project area is composed of timber-producing forest land. The Tepee Butte Fire created a mosaic of intensely burned, blackened timber, moderately burned areas where trees may still bear green foliage, and unburned islands of green timber. In addition to killing or severely damaging an estimated 252 million board feet of timber, the fire had important effects on soils and watersheds, wildlife and fish, as well as recreation and visual resources.

ALTERNATIVES

Following public scoping of the issues, the process of alternative development began. In their study of the affected environment, the Interdisciplinary Team (IDT) conducted field reconnaissance, collected data, and studied existing resource inventories. To help create a sufficiently broad range of alternatives, a "decision spectrum" was developed to display the components of each issue. The spectrum defines a range of acceptable management options related to each issue, extending from the No Action Alternative to a set of options which proposes the most aggressive action. All proposals are consistent with direction provided in the Hells Canyon NRA Comprehensive Management Plan. The team then developed themes for alternatives and selected appropriate combinations of proposed actions from the decision spectrum to respond to each identified issue.

The IDT was guided in this process by land management direction provided in the Comprehensive Management Plan (CMP). The CMP was prepared to fulfill requirements of legislation which established the Hells Canyon NRA, and it describes how the NRA is to be managed. The Draft EIS is tiered to the CMP.

Alternative A - No Action

The No Action Alternative would allow resources within the project area to recover naturally. There would be no road construction, salvage of fire-killed or damaged timber, nor would there be any other resource recovery activities. This alternative forms the baseline against which all other alternatives are compared.

Alternative G (Preferred)

To maintain healthy and diverse stands of timber over time is the objective of Alternative G. In addition, implementation of this alternative would maintain existing big game cover and re-establish cover that was destroyed by fire as quickly as possible. Although prescribed treatments are consistent with CMP direction for resources management, most recovery efforts would be directed toward vegetation management and wildlife habitat improvement. This alternative prescribes vegetation recovery treatment of the maximum number of acres, within constraints provided by the CMP.

Alternative G proposes to remove 30.7 MMBF of merchantable timber volume and allows for removal of approximately 3.5 MMBF of additional, optional volume. Road construction would total 5.2 miles; existing trails would be restored to their pre-fire condition.

Alternative H

Rehabilitation of big game cover and other wildlife habitat are emphasized under Alternative H. Implementation of this alternative would recover the value of other affected resources to a moderate degree.

Alternative H proposes proposes to remove 7.5 MMBF of merchantable timber volume and allows for removal of approximately 0.5 MMBF of additional, optional volume. Road construction would total 3.1 miles; existing trails would be restored to a level consistent with current management objectives.

Alternative I

Enhancement of recreation opportunities and the visual resource is the primary objective of Alternative I. Prescribed treatments will be consistent with the physical and social settings described in the CMP.

No timber volume would be removed under this alternative, and no roads would be constructed. Existing trails would be restored to a level consistent with current management objectives.

Alternative J

A moderate level of recovery of all affected resources is the objective of Alternative J.

This alternative proposes to remove 22.6 MMBF of merchantable timber volume and allows for removal of approximately 1.1 MMBF of additional, optional volume. Road construction would total 5.2 miles; existing trails would be restored to a level consistent with current management objectives.

COMPARISON OF ALTERNATIVES

This section presents comparisons of the alternatives by issue. Some of the more significant differences in resource output and environmental consequences are described.

Issue No. 1 - Recreation Resources

Implementation of any action alternative would completely restore recreation resources to their pre-fire condition. All fire suppression impacts would be mitigated. However, only under Alternatives H, I, and J would recreation sites be restored to beyond their pre-fire condition.

Alternative I proposes the maximum benefit to recreation resources. A variety of facilities would be provided at trailheads and along trails, all trails would be rigorously maintained, and several interpretive services features would be developed.

Alternative J provides for recreation resource recovery within strict cost parameters. All damaged sites, trails, and facilities would be restored to their pre-fire condition, and vegetative buffers would be provided to screen recreational use from salvage operations. Several trailheads would be relocated or consolidated to provide more accessible, attractive, and functional sites and to reduce conflicts with range management operations and wildlife populations. All trails would be improved to a level consistent with current management objectives. Scenic interpretive services sites would provide information about the history, ecology, and management of fire in the NRA.

Issue No. 2 - Visual Resource

All alternatives address the visual resource issue by meeting Visual Quality Objectives (VQOs) and by following CMP direction. For example, the CMP specifies that no human-caused opening in the timber canopy will be larger than 2 acres. Although, even while these criteria are met, a range of impacts would be created by implementation of any action alternative.

The overall Visual Condition of landscapes within the project area can be analyzed for change. Alternatives A, H, and I ensure no changes from the landscapes' fire-affected, slightly altered condition; and Alternatives G and J allow change from slightly altered to moderately altered.

Multiple variables determine tree mortality. Any prediction of which fire-damaged trees will die is not exact. Therefore, prescriptions for salvage in foreground areas may not, after salvage operations have been completed, comply with established VQOs. To ensure that VQOs are met, Alternative J prescribes 300-foot no-cut buffers along important roads and variable buffers adjacent to recreation sites and trail corridors. Alternatives G and H prescribe no buffers, but foreground areas would be evaluated and individual trees would be marked for salvage, as necessary, to comply with established VQOs.

The effect of alternatives on visual quality was compared by measuring the number of viewsheds exceeding the maximum disturbance thresholds for retention, partial retention, and modification VQOs. "Maximum Disturbance" is the total number of timber harvest and road development acres, calculated as a percentage for each VQO in each viewshed. Even though individual harvest units would meet VQOs, as a group or together they may disturb too much area at one time. Alternative G exceeds two MDTs and is under MDTs in all other viewsheds. Alternative H is under MDTs in all viewsheds. Alternative J exceeds one MDT, approaches one MDT, and is under MDTs in all other viewsheds.

Issue No. 3 - Water Quality/Fisheries

The expected effects on water quality and the fisheries resource are similar under all alternatives. Although each of the action alternatives proposes a different level of ground disturbance, buffers along Class I, II, and III streams, adherence to Best Management Practices, and prescribed mitigation measures are elements common to all of them. Because most of the proposed salvage activities are located away from Class I, II, and III streams, and most of the impacts are fire-induced, predicted differences among the action alternatives' expected impacts on water quality are small.

Alternatives G and I propose planting of indigenous shrubs along 23 miles of Class I, II, and III streams. Alternatives H and J propose planting 2.2 miles of these riparian areas.

Issue No. 4 - Wildlife Habitat

Wildlife habitat is evaluated in terms of the Habitat Effectiveness Index (HEI). Rocky Mountain elk populations, total areas of old growth habitat, snag levels, and miles of "countable" roads are measured in terms of this index.

None of the remaining mature and old growth habitat areas would be entered under any of the alternatives.

Elk Habitat Effectiveness Indices (HEI) which were calculated for all of the alternatives are lower than the pre-fire HEI. This is attributable to the loss and poor spacing of wildlife cover. It is therefore essential that remaining cover be retained under all alternatives.

Implementation of Alternatives G and H would result in the highest HEI of the alternatives considered. Because these alternatives propose the lowest open, "countable" road density, they offer the least possible harassment to wildlife.

Implementation of Alternative J would result in the next highest HEI, which is attributed to the second lowest open, "countable" road density.

Implementation of Alternative I would result in the third highest HEI, which is attributed to the third lowest open, "countable" road density.

Implementation of Alternative A would result in the lowest HEI because it maintains the highest open, "countable" road density. As a result, the No Action Alternative offers the most possible harassment to wildlife.

Alternative G and Alternative I propose hand planting deciduous shrubs in riparian areas along 23 miles of streamcourses on moderate- and high-intensity burn sites. Alternative H and Alternative J propose hand-planting deciduous shrubs within selected high-intensity burn riparian areas. Alternative A prescribes no planting in riparian areas.

Alternatives G and J propose to reforest the most acreage of all action alternatives. This recovery effort would provide cover for big game and habitat for animal species which depend on old growth. Alternatives H and I propose to plant the second and third largest number of acres, respectively. Alternative A would allow for only natural regeneration. Recovery of old growth habitat and big game cover would, therefore, be slower.

All of the alternatives provide for retention of sufficient quantities of large woody material for wildlife species that use this habitat.

All the alternatives are expected to retain enough dead trees (snags) to provide 100 percent of the habitat required by primary excavator and cavity dweller species which are found in the project area. However, some high-intensity burn areas which are not reforested will not provide replacement snags in the future.

Issue No. 5 - Long-term Site Productivity

Long-term site productivity differences among the alternatives are evaluated by the amount of soil compaction and soil damage which is not mitigated, the surface erosion rate for the first 10 years, and the amount of large organic debris remaining on the site following recovery activities.

The effects of all alternatives on long-term site productivity are similar; they are essentially fire-induced. Estimated erosion levels for Alternatives G, H, and J are within one percent of Alternative A, the No Action Alternative. The estimated erosion expected under alternative I is the same as is expected under Alternative A. Potential effects of the action alternatives would be mitigated through implementation of Best Management Practices. In addition, management of organic residue will reduce post-fire erosion levels and mitigate organic matter losses which were caused by combustion.

Issue No. 6 - Vegetation Management

Differences among the alternatives in levels of vegetation management are described in terms of miles of riparian plantings, acres of natural and artificial regeneration, changes in forage production, and maintenance of free passage within treated areas (operability).

Alternatives G and I propose planting riparian areas along 23 miles of Class I, II, and III streams; Alternatives H and J propose planting along 2.2 miles.

Alternative G proposes the largest total area of artificial regeneration following salvage activities (877 acres). Alternative J proposes 608 acres of artificial regeneration following salvage harvest, and Alternative H proposes 170 acres. No artificial regeneration would be accomplished under Alternative I. Under Alternatives H and J artificial regeneration would be performed on 269 acres where timber will not be harvested; and Alternative I proposes 303 acres of artificial regeneration on such areas.

All alternatives are expected to result in increases in forage for both wildlife and domestic livestock in the short term.

Alternative G is expected to yield the greatest improvement in future operability and vegetation management options within the Dispersed Recreation/Timber Management (DR/TM) land allocation (3,084 acres). Alternatives H, I, and J yield 911 acres, 0 acres, and 2,701 acres, respectively.

Issue No. 7 - Transportation System

Three road management options were developed for the various alternatives. They are:

1. High - Provides the greatest amount of road closures to mitigate the loss of big game cover.

2. Moderate - Provides a medium amount of road closures, and is designed as a compromise between the high and low options.

3. Low - Provides a low amount of road closures to increase access for dispersed recreation.

Alternatives G and H include the high road management option. This option would remove 12.4 miles of road from the transportation system while keeping 30.5 miles of transportation system roads open for public use. Alternative I proposes to remove 11.3 miles from the system while keeping 42.3 miles open for public use. Alternative J proposes to remove 12.2 miles of road from the system while keeping 36.8 miles open.

Under Alternatives G, H, I, and J, 3.9, 2.7, 0.0, and 3.9 miles of roads would be constructed. Of those totals, 1.3, 0.4, 0.0, and 1.3 miles would be obliterated and put to bed following recovery activities.

Issue No. 8 - Rapid Timber Recovery

There is an estimated total of 252.4 MMBF (gross volume) of dead and severely damaged timber within the entire fire area. Of this total, 7.5 MMBF is on other ownerships, 0.4 MMBF is on BLM land, 0.4 MMBF is on the Wallowa-Whitman National Forest's Wallowa Valley District, and 244.1 MMBF is on the Hells Canyon NRA.

Not all of this gross volume is merchantable. Nearly seven percent (16.6 MMBF) was dead (insect or disease mortality) before the fire and does not contain merchantable volume. Also, the one-year-or-greater delay between the fire and harvest will result in volume losses to weather, in the form of wood cracking and checking in small fire-killed trees and in the top logs of larger trees. Quality lumber can not be milled from timber affected in this way. Within all land ownerships, this depreciation will account for an estimated volume reduction of approximately 24 percent (59.8 MMBF). The net merchantable volume estimate for affected timber on all ownerships is 176 MMBF. The net merchantable volume estimated to be on the Hells Canyon NRA is 170.7 MMBF.

Estimated volumes within the Hells Canyon NRA are: 70.8 MMBF in the Dispersed Recreation/Native Vegetation (DR/NV) allocation, 52.5 MMBF in the DR/TM allocation, and

47.4 in the Forage allocation. Each CMP allocation prescribes management direction that determines the how much volume may be harvested and in what way(s).

Alternative G would treat the largest area for vegetation recovery while protecting all other resources as required by the CMP. Under Alternative G 30.7 MMBF, or 18 percent of the NRA net volume, would be harvested. Of this volume, 15.8 MMBF would be removed by helicopter, 11.8 MMBF by tractor, and 3.1 MMBF by cable systems.

Under Alternative H, 7.5 MMBF, or 4.4 percent of the NRA net volume, would be harvested. Of this volume, 3.5 MMBF would be removed by helicopter, 3.3 MMBF by tractor, and 0.7 MMBF by cable systems.

Under Alternative J, 22.7 MMBF, or 13.3 percent of the NRA net volume, would be harvested. Of this volume, 10.9 MMBF would be removed by helicopter, 8.7 MMBF by tractor, and 3.1 MMBF by cable systems.

Fire-killed or damaged timber would not be salvaged under Alternative A, the No Action Alternative. Because Alternative I proposes only recreation resource recovery and enhancement projects, salvable timber volume would be incidental to project operations.

The volume proposed to be sold under each alternative could easily be harvested within one year of contract award.

Issue No. 9 - Economics

Economic effects are evaluated in terms of three major factors: net cash flow to the people of the United States; the amount of Forest Service payments to local counties; and direct and indirect employment opportunities.

Major items that would affect these values are: volume of timber harvested; method(s) of harvest; miles of roads to be constructed or reconstructed; total number of acres reforested; and the effect of these actions on the number of big game hunting tags which are issued for the project area.

Specific items which were included in the analysis were: salvage harvest (timber sales), commercial mushroom gathering, various resource projects for watershed enhancement, recreation improvements, wildlife habitat, cultural resources, and big game hunting.

For each action alternative, economic analyses include estimates of:

1) Present net value (PNV) for a 10-year planning horizon, including salvage sales which are projected for 1989 and 1990;

2) Receipts to counties from harvested timber volumes; and

3) Direct jobs and wage income generated from the timber sales program and other resource improvements in the project area.

Total gross revenues to the US Treasury would vary, from $0.00 under Alternatives A and I to a maximum of $293,000 under Alternative G. Alternatives H and J would return $72,000 and $215,000, respectively.

Total project implementation costs would vary, from $0.00 under Alternative A, to $7,857,000 under Alternative G. The projected cost of implementing Alternative H is

$2,699,000, of implementing Alternative I $962,000, and of implementing Alternative J $6,309,000. Costs of implementing resource recovery and recreation improvement projects are included in these estimates. The recovery/recreation costs vary, from $881,000 under Alternative H to $1,329,000 under Alternative J. The costs of recovery and recreation projects prescribed under Alternative G and Alternative I are $1,222,000, and $962,000, respectively.

The PNV of the alternatives varies, from $11,047,000 under Alternative G to $18,503,000 under Alternative A. The value of big game hunting is included in these estimates. Alternative A reflects no reduction in the number of deer and elk tags that were issued for the area before the fire. The other alternatives anticipate reductions in the number of tags issued, based on estimates provided by the Oregon Department of Fish and Wildlife. Alternative H reflects a PNV of $13,667,000, Alternative I a PNV of $13,613,000, and Alternative J a PNV of $11,600,000.

Estimated receipts to Wallowa County vary widely. Alternative G would generate about $73,000. Alternatives A and I would generate no payments. Alternatives H and J would produce $18,000 and $54,000 respectively.

Effects on employment levels associated with each alternative range from no increase under Alternative A to an estimated 203 direct and 127 indirect positions which would be either maintained or created under Alternative G. Alternative I would produce about 80 direct and 37 indirect jobs; H would produce about 107 direct and 57 indirect; and Alternative J would produce 175 direct and 105 indirect jobs.

No values were assigned for future timber harvests. It is not known at this time what effect the fire will have on future yield and timber harvests levels within the NRA.

CHAPTER I

PURPOSE AND NEED

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CHAPTER I

PURPOSE OF AND NEED FOR ACTION

INTRODUCTION

The summer of 1988 was the third year that drought conditions had occurred in Northeast Oregon. The weather was hot and dry with fuel moisture conditions at their lowest levels of the season. On August 25, a lightning storm moved through the region north of Tepee Butte and ignited a fire on private land north of Lent Canyon.

Due to favorable burning conditions and strong winds, the fire moved rapidly, consuming over 14,000 acres in the first eight hours. During this time, it moved onto National Forest land set aside by Congress in 1975 as the Hells Canyon National Recreation Area of the Wallowa-Whitman National Forest and frequently referred to as the Hells Canyon NRA. The fire was finally declared controlled on September 8 after burning 59,740 acres.

The fire area is bounded to the north and east by the Snake River, to the south and west by Forest Road 46 and the Wallowa Valley Ranger District of the Wallowa-Whitman National Forest, and to the southeast by Forest Road 4600780 and the Yureka Creek Trail 1732.

Before the fire was controlled the Forest Service activated the fire rehabilitation recovery team which implemented emergency activities to reduce the adverse effects of the fire on the burned area. This implemented several activities including grass seeding to reduce erosion and rehabilitation of control lines constructed for fire control.

A proposal to recover and protect various resource values in the Tepee Butte Fire area created the need for this Draft Environmental Impact Statement (DEIS). Some of the values affected by the burn were recreation opportunities, scenery, trails, water quality, vegetation, and soil. The decision to be made is "what, if any, site-specific projects should be implemented for the salvage and recovery of natural resources within the Tepee Butte Fire area?"

The decision to prepare an EIS for the Tepee Butte Fire Recovery Project was influenced by several concerns including the potential cumulative effects of the fire in combination with recovery project activities on watersheds and fish habitat and the historical controversy associated with salvage timber sales in the Hells Canyon National Recreation Area. The purpose of the DEIS is to predict and disclose impacts of various proposals on resources within the planning area. This decision complies with the National Environmental Policy Act of 1969 (NEPA), which requires the preparation of such documents when major Federal actions significantly affect the quality of the human environment.

The DEIS displays the results of an environmental analysis sufficiently detailed to assist decision makers determine what, if any, project work should be done and informs them about the environmental consequences of different recovery alternatives. Equally important, it informs the public about the analysis results and encourages public participation in developing and refining that information.

In addition, reasonable options for avoiding or minimizing adverse environmental impacts associated with recovery alternatives were developed and analyzed for evaluation by decision makers and the public. This analysis will enable the Forest Service to address conditions caused by the fire in the Hells Canyon NRA.

Five alternatives for recovery of the area were fully developed by the Forest Service with active assistance from interested individuals and organizations. An Interdisciplinary Team (IDT) conducted the environmental analysis which forms the basis for this document. Each alternative affects the environment differently, delivers different recreational opportunities, requires different expenditures, and has different implications for the local economy. These differences were carefully analyzed.

Land in the Tepee Butte Fire Recovery Area is managed according to direction in the Hells Canyon National Recreation Area Comprehensive Management Plan (CMP), approved May 28, 1981, with a subsequent Record of Decision dated April 29, 1982 and further amended by appeal decisions in 1983 and 1984. The CMP was required by PL 94-199, which created the Hells Canyon NRA. This DEIS is tiered to the CMP. The CMP is proposed to become part of the new Wallowa-Whitman National Forest Land and Resource Management Plan (Forest Plan) which is currently under preparation.

Public Law 94-588 (National Forest Management Act) enables the Forest Service to continue managing units of the National Forest System under existing land and resource management plans pending completion of the Forest Plan. A decision on the Tepee Butte Fire Recovery Project EIS is expected before final approval of the Forest Plan.

The CMP designates four management area allocations in the project area: Dispersed Recreation/Native Vegetation (DR/NV) (34,136 acres), Dispersed Recreation/Timber Management (DR/TM) (10,258 acres), Forage (9,093 acres), and Scenic River Corridor (615 acres). A summary of management directions for each of these allocations is presented in the Glossary, and the complete explanation may be found in the CMP.

The planning steps leading to the development of this DEIS were:

1. SCOPING to characterize the proposed action and nature of the decision, identify agencies involved and the responsible official, identify public issues and management concerns, convene an interdisciplinary team, and solicit public involvement.

2. COLLECTING AND INTERPRETING DATA that is responsive to the planning problem, issues, and concerns.

3. DEVELOPING ALTERNATIVES, one of which is No Action.

4. ESTIMATING THE EFFECTS OF THE ALTERNATIVES, including the proposed action (preferred alternative).

5. EVALUATING THE ALTERNATIVES, including the proposed action.

6. IDENTIFYING THE PREFERRED ALTERNATIVE.

Planning process records, the documents and files which chronicle the above planning steps, are available at the Forest Supervisor's Office, Wallowa-Whitman National Forest, Baker, Oregon.

Government agencies and the public are being consulted for comments on this DEIS which will be used in the subsequent preparation of a Final EIS. These comments will be assessed and responded to in several ways, which may include modifying existing alternatives, evaluating new alternatives, or explaining why a comment does not warrant further agency response. The Final EIS will then be used by the Wallowa-Whitman National Forest Supervisor as the basis for a Record of Decision.

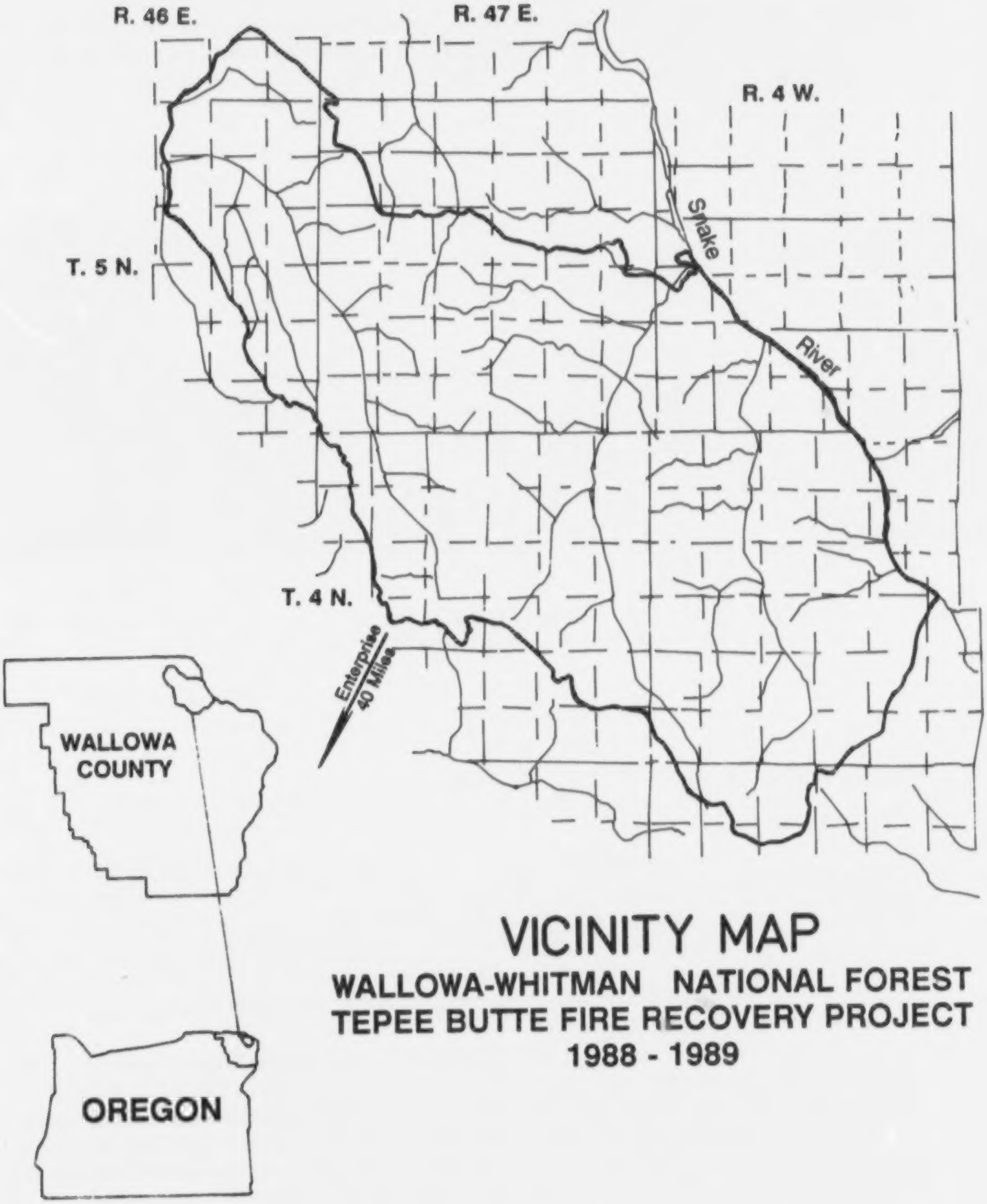
Implementation of the decision will be carefully monitored to ensure that planned mitigation measures are carried out and that environmental predictions made about the results are assessed for accuracy.

The Hells Canyon NRA was established in 1975 to protect the area's natural beauty and historical and archaeological values.

OVERVIEW OF THE PROJECT AREA

The 60,000 acre Tepee Butte Fire Recovery Project area, also referred to as the project area, is located mostly in the Hells Canyon National Recreation Area (NRA) approximately 30 miles northeast of Enterprise in Wallowa County, Oregon. Most of the area is administered by the U.S. Department of Agriculture, Forest Service, Wallowa-Whitman National Forest. Portions of the area outside the NRA are administered by the U.S. Department of Interior, Bureau of Land Management. Additional parcels are privately owned.

The boundary of the planning area is the outer edge of the Tepee Butte burned area. The planning area does not include 104 acres on the Wallowa Valley Ranger District of the Wallowa-Whitman National Forest. The Tepee Butte Fire did not encroach into any wilderness. (See vicinity map) The burn is 14 miles long from north to south and approximately 15 miles wide from east to west. The burn is generally bounded by the Snake River on the east and Wildhorse Ridge on the west and Forest Service Road 46 on the south.


R. 46 E.
R. 47 E.
R. 4 W.
T. 5 N.
T. 4 N.
Snake
River
Enterprise
40 Miles
WALLOWA
COUNTY
OREGON

VICINITY MAP

WALLOWA-WHITMAN NATIONAL FOREST

TEPEE BUTTE FIRE RECOVERY PROJECT

1988 - 1989

The Tepee Butte Fire Recovery Project area offers spectacular geographic variety common to the Hells Canyon NRA. Within the Hells Canyon NRA, the most striking feature is Hells Canyon, the deepest gorge in North America. Within the project area the land ranges in elevation from 900 feet on the Snake River to 5400 feet above sea level. Vegetative patterns include timbered plateaus at the highest elevations grading into steep timbered stringers with many intricate branching ravines that in turn grade into grasslands at the lower elevations.

A system of alternating ridges and drainages, extends north and south parallel to the main Snake River canyon. The principal ridges in this pattern include Wildhorse, Cold Spring, Deadhorse, and Cemetery.

Vegetation before the fire included brushfields, grasslands, and sites with scattered trees, comprising about 60 percent of the project area. The remaining 40 percent consists of well-timbered forest lands. Coniferous tree species in the forested areas include Douglas-fir, grand fir, ponderosa pine, western larch, Engelmann spruce, lodgepole pine, and subalpine fir. Hardwood species include quaking aspen, willow, black cottonwood, alder, and Rocky Mountain maple. Major ground vegetation species are big huckleberry, snowberry, ninebark, queen's cup, twinflower, pinegrass, heartleaf arnica, spirea, vetch, mitella, pipsissewa, and Oregon anemone.

Major grassland plant associations are Idaho fescue/prairie junegrass, stiff sagebrush/Sandberg's bluegrass, and Idaho fescue/bluebunch wheatgrass.

A number of uncommon plants, some of which are considered sensitive species by the Pacific Northwest Region of the USDA Forest Service, occur in the area. (See Chapter III, Threatened, Endangered, and Sensitive Species.)

Soil productivity within the project area varies by soil depth, geology, presence or absence of volcanic ash, and precipitation amounts. The most productive soil types are characterized by surface layers of volcanic ash. Some areas located in the mixed geology types along the steep canyonlands adjacent to the Snake River have been mapped as being unstable.

Mule deer, black bears, mountain sheep, cougar, and elk occupy the area, and both anadromous and resident fish inhabit the major streams, possibly including the redband trout, a sensitive species on the USDA Forest Service Pacific Northwest Region Sensitive Fish List (1987). This sensitive species list may be found at the Forest Supervisor's office in Baker, Oregon or the Forest Service Pacific Northwest Regional Office in Portland, Oregon. Old growth and mature forests provide habitat needs for numerous species of birds and terrestrial wildlife. Bald and golden eagles use habitat along the Snake River. The project area contains potential habitat for peregrine falcons, an endangered species. Peregrine falcons have been reintroduced at two sites, 14 and 20 miles from the project area, but whether this species has established residence within the project area is not known.

HISTORY

Long before historical records were kept, Indians inhabited Hells Canyon. They were drawn by the relatively mild winters, the abundance of edible plants, available fish, and the geographic location. The area is on the boundary between the Great Basin and the Columbia Plateau, two distinctly different Indian culture areas.

Beginning with the Lewis and Clark Expedition in the early 1800's, explorers, traders, gold seekers, and eventually homesteaders began competing with the Indians for use of the land and resources. Following the Nez Perce War of 1877, the Indians were forceably removed from the Hells Canyon area.

By 1880, white settlement of Hells Canyon and the Imnaha Valley had begun in earnest and continued into the early 1900's. Homesteading in this remote and rugged country lagged behind other more accessible areas. For nearly a century, people used the area for farming, ranching, and mining activities. Sheep and cattle grazing occurred and presently continues under management in National Forest grazing allotments. Some mining has occurred.

Idaho Power Company was licensed in 1955 to construct and maintain dams and hydroelectric generating plants at Oxbow, Brownlee, and Hells Canyon dam sites. The three dams were constructed by 1968.

The Hells Canyon NRA was established by Public Law 94-199 on December 31, 1975. After several years of intensive lobbying, the legislation was passed precluding further hydropower development and protecting the area's "natural beauty, and historical and archaeological values".

The Act creating the Hells Canyon NRA specifies that the land and resources be administered in accordance with the laws, rules, and regulations applicable to the National Forests for public outdoor recreation in a manner compatible with a series of various objectives. These include:

* Maintaining and protecting the free-flowing nature of the rivers within the Hells Canyon NRA.

* Conserving scenic, wilderness, cultural, scientific, and other values contributing to the public benefit.

* Preserving all features and peculiarities believed to be biologically unique including rare and endemic plant species, rare combinations of aquatic, terrestrial, and atmospheric habitats, and the rare combination of outstanding and diverse ecosystems and parts of ecosystems associated therewith.

* Protection and maintenance of fish and wildlife habitat.

* Protecting archaeological and paleontological sites and interpretation of these sites for the public benefit and knowledge insofar as it is compatible with protection.

* Preserving and restoring historic sites associated with and typifying the economic and social history of the region and the American West.

* Such management and utilization and disposal of natural resources on federally owned lands, including, but not limited to, timber harvesting by selective cutting, mining and grazing, and the continuation of such existing uses and developments as are compatible with the provisions of the Act.

In addition to the Hells Canyon NRA, other parcels of land and water were recognized as needing special designation or protection. A portion of the Snake River was included in the National Wild and Scenic River System in 1968; additional miles were included in 1988. The Oregon Wilderness Act of 1984 added several thousand additional acres in and around the NRA to become part of the National Wilderness Preservation System.

Further damming of the Snake River and its tributaries within the NRA for the purpose of hydropower was prohibited. Subject to existing valid rights, Federal lands were withdrawn from all forms of location, entry and patent under United States mining laws. Provisions were made for the transfer of other Federal property located within the area to the Secretary of Agriculture to meet the purpose of the Act.

KEY ISSUES

Controversy associated with land management in the Hells Canyon NRA is long-standing. Because of the area's unique character and sensitive ecosystems, some special-interest groups have opposed developments, such as roads, trails, and timber harvest sites. Some of those groups have maintained that either additional areas be designated as Wilderness or the area be redesignated as a National Park preserve. In contrast, other groups believe parts of the NRA should be managed to produce high levels of commodities, especially wood products.

Scoping the Key Issues--The Forest Service recognized that the Tepee Butte Fire and its aftermath would rekindle debate about best use. Public involvement in recovery planning began even before the fire was extinguished. Radio interviews and newspaper articles were used to keep the public informed of the 1988 emergency watershed rehabilitation effort and the subsequent decision to study the fire area in depth. A Notice of Intent to prepare an Environmental Impact Statement was published in the *Federal Register* October 7, 1988. The need for salvage operations and concerns about the potential roading of unroaded areas were debated throughout the community.

The Wallowa-Whitman National Forest Supervisor solicited comments through ads in the *Wallowa County Chieftain*, Enterprise; *The Observer*, La Grande; *Democrat-Herald*, Baker; *Argus Observer* and *Morning Tribune*, Ontario; and the *Hells Canyon Journal*, Halfway, all in Oregon, and the *Morning Tribune*, Lewiston, Idaho. More than 350 requests for further information and updates were returned to the Forest Service. An "open door" invitation was extended to every individual, group and agency contacted. Local community, County, State, and Federal officials were also contacted and provided counsel.

In the fall of 1988 four public scoping meetings were held in the communities of Enterprise (November 2), La Grande (November 7), Baker (November 8), and Halfway (November 10). Separate meetings with timber industry workers and managers (October 31 and November 21) and environmental groups (field trip October 23 and meetings December 19 and 21) provided opportunity for these people to express their concerns.

Representatives of both the Nez Perce Indians (Lapwai, Idaho) and the Confederated Umatilla Tribes (Pendleton, Oregon) were contacted for input. The Columbia River Inter-tribal Fish Commission met with team representatives January 5, 1989.

Resource specialists displayed exhibits and explained their work at two open houses in Joseph and Baker, Oregon, on December 13 and 15, 1988, respectively.

Internal scoping of issues included reviewing the Draft Forest Plan, Public Law 94-199, the Final Environmental Impact Statement and Comprehensive Management Plan for the Hells Canyon NRA, and previous Hells Canyon NRA timber sale environmental assessments.

According to NEPA, the range of alternatives considered in detail must be responsive to the major issues and be within the physical, biological, and legal limits of forest management. Developed from the many sources detailed above, the nine issues described below were used to develop and compare alternative courses of action.

The order in which the issues are presented is in no way intended to reflect their order of importance. They are all important.

Recreation Resources

The project area provides recreational opportunities that are dependent on a predominately natural or naturally appearing environment. The area is used for a variety of activities such as big game hunting, camping, sightseeing, firewood cutting, backpacking, horsepacking, day hiking, bird watching, mushroom gathering, and all-terrain vehicle travel. Retaining opportunities for quality recreation and limiting alteration of the natural setting are emphasized in the CMP. In resolving the recreation resource issue, the following questions emerge:

-- What changes in the recreation setting would result from recovery operations?

-- What changes in use patterns would result from recovery operations?

-- What opportunities exist to consider changes in access and development?

-- What type and amount of trail maintenance is required to repair the trail system?

-- What level of restoration is required to maintain the recreation sites?

-- What opportunities exist to interpret the role of fire in the ecosystem and the agency's fire management responsibilities?

-- Where should hazard trees be removed for public safety?

-- What level of recovery activities are consistent with maintaining the physical and social setting described in the CMP for the four allocations?

The project area is used for a variety of activities such as sightseeing, hiking, wildlife watching, hunting and camping.

Visual Resource

The project area provides ample opportunities for viewing the scenic attributes of the natural environment. Viewing scenery is a major reason for public visits to the Hells Canyon NRA, and preserving scenic values is a primary management objective. The visual resource issue raises the following questions:

-- How much visual disturbance is acceptable in implementing recovery or salvage projects?

- How should the effects of recovery operations and fire suppression be mitigated?

- What opportunities exist for enhancement of the visual resource?

Water Quality/Fisheries

Clean, cool water is required to support a healthy population of resident and steelhead trout. Loss of vegetation on hillsides and in riparian areas due to fire will result in increased sediment entering the streams, increased stream temperatures, increased peakflows, and a loss of organic (leaves, twigs, insects) input to the stream system. Road construction, timber harvest, and livestock grazing can further aggravate these impacts on water quality. Concerns for water quality and fisheries in the project area are:

- How should riparian areas be treated to prevent additional degradation and to improve the rate of their restoration?

- What management activity adjustments should be implemented during road construction, timber harvest, and livestock grazing to prevent or minimize detrimental effects on water quality/quantity and fish habitat?

- What will the cumulative effects of management activities be on fish habitat within and downstream from the fire area.

- How can the predicted impacts of the fire and management activities be monitored?

Wildlife Habitat

Alteration of wildlife habitat by the fire may be compounded by recovery activities. The fire resulted in loss of cover for big game and other wildlife species. This issue generates the questions:

- How will the remaining cover and future cover for both game and non-game animals be managed?

- How will big game travel corridors be managed?

- How can old growth values for game and non-game animals be best provided?

- How will roads affect habitat?

- How can the riparian habitat areas lost in the fire best be recovered?

- How has the snag habitat changed and what are the management options?

Long-Term Site Productivity

Long-term site productivity is dependent on maintenance of the natural physical and chemical properties of the soil and the continued addition of organic matter and its associated nutrient reserves into the soil/vegetative system. There is concern that the fire has severely impacted long-term site productivity by removing woody debris, litter, and organic matter and by exposing the soils to erosion. The issue of long-term site productivity becomes questions of:

-- How has the fire affected long-term site productivity potentials through losses of woody debris and organic matter and increases in soil erosion potentials?

-- Will salvage operations further decrease long-term site productivity potentials through soil erosion, compaction and displacement?

-- What mitigation measures can be implemented to minimize impacts of management activities or mitigate the loss of woody debris in contact with the soil?

Vegetation Management

A fire has immediate and long-term effects on vegetation including timber stands. The immediate effect changes the stand structure and species composition. The long-term effect comes from successional changes in the stand caused by the death of the trees as well as the associated effects on water yield, forage production, wildlife habitats, and future fire hazards. Both the immediate and long-term effects will also vary depending upon whether the dead timber is harvested, and whether tree seedlings are planted or exotic grasses are introduced. There is concern about the amount of reforestation that would take place and whether accomplishment would be by natural regeneration or by planting. This issue addresses:

-- How is stand structure and composition modified by the fire and with each recovery alternative?

-- What will be the ecological succession following the forest fire and implementation of each alternative?

-- How many acres and what areas would need to be reforested? Which areas need to be artificially reforested versus those that would depend on natural regeneration? What will the timeframes be for each method of regeneration?

-- What provision should be made to regenerate conifers and deciduous shrubs within the riparian management zones?

-- How will forage production change?

-- How does removal of fire-killed timber affect long-term operability and long-term fire hazard reduction?

-- What should be done if the erosion seeding impedes coniferous tree re-establishment?

Transportation System

The public has concerns about the roading possibilities resulting from recovery projects. The responses to the transportation system range from requests for maximum roading for salvaging all affected timber volume to building no new roads at all. The management objectives and guidelines for the transportation system are identified in the Hells Canyon NRA's Comprehensive Management Plan (CMP). Given the amount of unroaded area within the project that could be developed to salvage timber, the questions to be resolved are:

- How to interpret the objectives and guidelines in the CMP as they relate to the amount and kinds of roads that could be constructed by the project given the resource concerns and values of the Hells Canyon NRA?
- What type(s) of roads should be built--temporary or permanent?
- Where should proposed roads be located?
- What roads should be closed, and how would they be closed?
- What optional logging systems and associated road choices are available?

Rapid Timber Recovery

The Tepee Butte Fire Recovery Project area contains substantial amounts of fire-killed and severely damaged timber. The primary timber-producing species are Douglas-fir, grand fir, ponderosa pine, western larch, Engelmann spruce, lodgepole pine, and subalpine fir. Fire-killed timber begins to deteriorate immediately. Because of weathering, insects, and decay, the volume and commercial value of fire-damaged dead and dying timber will decline rapidly over time. The issue becomes questions of:

- How many acres of timber and silvicultural treatment are involved, and how much commercial wood volume and value is to be salvaged?
- What commercial timber volume and value may be lost to deterioration before salvage could be completed?
- What time factors are associated with potential salvage operations such as road building, logging systems, economic constraints and other items?

Economics

Any activities which are undertaken on the project area will produce effects on both the local and state economies. Depending on the range of recovery projects proposed, a significant change in local employment and income levels could occur. The harvest of the fire-killed and damaged timber has the potential of having the largest single effect. This could range from no impact to a significant impact which could stress the ability of the local market area to process the timber volume. Other projects, i.e., watershed protection, recreation restoration/enhancement, would also affect local economies, but in smaller amounts. In order to assess what the change may be, an economic analysis of the proposed projects' costs and benefits is needed. The important questions generated from the economic issue are:

- What would be the economic effects of each project undertaken (Present Net Value, Benefits, Costs, deficit, jobs and income)?
- How would these activities affect the receipts to the U.S. Treasury and the 25 percent share returned to the local counties?
- What would be the long-term economic effect of the rehabilitation activities?

The fire area contains substantial amounts of fire-killed and severely damaged timber.

OTHER CONCERNS

Not all points and questions raised during scoping are directly reflected in the nine major issues detailed above. Many of these additional items are addressed in mitigation measures, followup monitoring, or alternatives that were not fully developed.

Some concerns raised were not analyzed in detail because they are beyond the scope of the decision being made. The paragraphs below discuss these issues which were not analyzed.

Annual Programmed Timber Harvest

Although much of the area's economy is derived from recreation and agriculture, Enterprise and Joseph, Oregon, and numerous other surrounding communities, are also economically dependent on the timber products industry. Because a reduction in log supply from privately owned lands is anticipated during the next 15-20 years, concern about the annual allowable harvest from public lands including Hells Canyon NRA is intense.

During scoping for the project, questions were often raised about the relationship between the timber that might be salvaged and the annual programmed harvest of approximately 7 MMBF from the Hells Canyon NRA. Some suggested that the total volume salvaged should replace the annual harvest from Hells Canyon NRA for one or more years.

The National Forest Management Act (NFMA, 1976) provides independent authority to the Forest Service to salvage timber stands damaged by fire or other catastrophes, and allows for this volume to either substitute for timber that would otherwise be sold under the CMP or to be sold over and above the CMP volume at the discretion of the Forest Service ((16 USC Sec. 1611(b)). The regulations apply to the entire National Forest System including National Recreation Areas such as the Hells Canyon NRA ((36 CFR 219.27(c)(1),(2)).

Salvaging fire-killed and damaged timber volume in excess of the annual green timber harvest amount is consistent with and in conformance with the Hells Canyon NRA Act and NFMA so long as the action furthers the purposes of the Hells Canyon NRA Act by maintaining or enhancing recreational values and public enjoyment.

The reduction of standing timber volume and growing stock, as a result of the fire and salvage, will be evident in future timber inventories and will influence future annual allowable sale quantity calculations.

Amending the Hells Canyon NRA Comprehensive Management Plan

The suggestion to change the Hells Canyon National Recreation Area Comprehensive Management Plan rather than to follow its current direction when dealing with the Tepee Butte Fire Recovery is not within the scope of this project; instead, the Tepee Butte DEIS will tier to the CMP.

Potential for Insect Infestation

Some segments of the public are concerned that a bark beetle epidemic may develop in the fire-damaged timber and become a threat to undamaged stands outside of the project area. As explained in the "Insects" section of Chapter III and in Appendix E, Forest Service specialists have investigated this concern. After consideration of all factors and examination of other recent fires under similar conditions in the Blue Mountains, the Forest Service entomologist concluded that an outbreak population of bark beetles building up in fire-injured timber and moving into surrounding stands to kill uninjured Douglas-fir is not predicted.

Domestic Livestock Grazing and Range Condition

Fire changed the range resource conditions for which the present allotment management plans were written. The Interdisciplinary Team (IDT) recognized that range resources will continue to change over the next few years. Additional information will be collected over the next several years and appropriate adjustments will be made in the respective management plans as needed to meet objectives. In the interim, a two-year suspension of grazing is in effect on the Cherry Creek, Jim Creek, and Cold Spring Allotments covering a majority of the burned area. This EIS will set riparian condition objectives for recovery (See Appendix D, Best Management Practices 6A, 6B, and 6C).

Fire Hazard

The fires of the 1986 and 1988 seasons generated concern that current management activities within the Hells Canyon NRA and surrounding lands, coupled with the increase of dead and dying trees from disease and insect infestations, may increase the risk and intensity of wildfire due to increased fuel loading. In addition, fire-stressed trees are more susceptible to disease and insects creating an opportunity for the cycle to repeat and intensify. Although post-fire hazard is not deemed great enough to warrant detailed analysis, this risk will be evaluated for each alternative.

Miscellaneous Items

The following miscellaneous points, questions, comments, and suggestions raised during scoping were not included in the analysis because they are either not relevant to the decision being made, beyond the scope of the analysis, or precluded by law or higher level decisions:

1. Some segments of the public were concerned about the time involved in preparing environmental impact statements (EIS) because some timber that might otherwise be salvable would deteriorate in the meantime. They suggested writing an environmental assessment or an EIS for the Dispersed Recreation/Timber Management allocation only. The Forest Service has determined that the proposal to salvage fire-affected timber in the Hells Canyon NRA is highly controversial and that a potential for significant cumulative impacts to water resources exists. Therefore, preparation of an EIS is appropriate. Preparation of more than one EIS (for the different land use allocations) would incur excessive cost and is otherwise impractical.

2. Some concerned individuals suggested using horse logging or pack mules in conjunction with helicopter yarding to avoid constructing new roads. All practical logging methods will be considered for any timber salvage projects that may be implemented.

3. Some suggested diversifying the local economy to reduce the dependence upon logging. This idea is beyond the scope of the decision being made.

4. Some people commented that public involvement began too late in the year (November) for interested parties to visit the ground. The Forest Service has conducted the various phases of the Tepee Butte Fire recovery effort as quickly as circumstances permit.

5. It was suggested that damaged trees be yarded and stacked for woodcutters. Making some of the wood available for woodcutters was considered in the alternatives. The project area's remote location makes woodcutting as the sole method of utilization impractical because the volume of damaged trees is too great, and additional costs incurred would be prohibitive. Yarding damaged trees, be it for sawlogs or firewood, will result in comparable environmental effects.

DEIS ORGANIZATION

Alternative ways of addressing the issues are described in Chapter II. Different alternatives produce different mixes of goods, services, and forest conditions. The alternatives are displayed in a format that allows comparison of the environmental impacts of each alternative and develops a response to each of the identified issues. Mitigation measures available to avoid or reduce environmental impacts are described. The preferred alternative is identified in Chapter II.

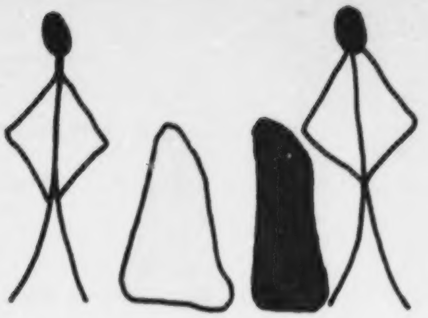
The land and resources as they were before the fire and as they are now are described in Chapter III, the Affected Environment. Environmental conditions necessary to address issues are discussed.

Physical, biological, social, and economic impacts that would result from implementing each alternative are disclosed in Chapter IV, "Environmental Consequences". Long- and short-term effects, both direct and indirect, are considered and measures taken to mitigate them are discussed. Particular attention was given to cumulative effects, the incremental impact of combinations of activities over time. Irreversible or irretrievable commitments of resources and any unavoidable, adverse environmental impacts are also discussed in this chapter.

A list of preparers, which follows Chapter IV, includes names and qualifications of persons primarily responsible for producing this document.

A glossary defining abbreviations, acronyms, and terms is located after the last chapter. Abbreviations are defined at first mention in each chapter as well as in the glossary; most terms are defined only in the glossary to avoid excessive interruption of the text. A list of literature citations in the DEIS is also provided. Reviewers will find it helpful to consult maps showing management direction proposed in each alternative.

Analytical reports and similar information needed to substantiate important analysis results are included in Appendices A through L. An analysis file containing process papers and other material is available at the Forest Supervisor's Office in Baker, Oregon.



CHAPTER II

ALTERNATIVES

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CHAPTER II

ALTERNATIVES, INCLUDING THE PROPOSED ACTION

INTRODUCTION

Chapter II is the heart of the Environmental Impact Statement. It explores and evaluates a reasonable range of alternatives, including a "No Action" alternative as required by the National Environmental Policy Act (NEPA). The chapter is intended to provide the public and the decisionmaker with a clear basis for choice.

Alternatives were developed by the Interdisciplinary Team (IDT) and are based on analysis of the issues. Five alternatives for managing land and resources in the Tepee Butte Fire Recovery Area are described, compared, and evaluated based on information presented in the Environmental Consequences Chapter (IV). For the best understanding of the five alternatives, reviewers should consult Chapter III, which describes conditions as they now exist in the project area.

An alternative is a mix of activities and schedules designed to accomplish a particular emphasis or theme. Each alternative is a different response to issues and concerns identified by the public and Forest managers during scoping.

This chapter contains 6 sections: (1) a discussion of how the alternatives were developed, (2) a description of how the alternatives were analyzed, (3) an explanation of the alternative approaches that were considered but later eliminated from in-depth analysis, (4) a detailed description of the five alternatives including mitigation and monitoring measures, (5) a comparison and evaluation of the alternatives, and (6) identification of the preferred alternative.

Measures which will be taken to reduce adverse environmental effects in all alternatives are described. This section also indicates how the effectiveness of these measures will be monitored.

ALTERNATIVE DEVELOPMENT PROCESS

The IDT developed four alternatives to achieve recovery objectives within the scope of the issues identified in Chapter I. The No Action Alternative was also developed. These alternatives were designed to explore a variety of ways to address the issues within the guidelines of the Hells Canyon NRA Comprehensive Management Plan (CMP). They represent a broad range of management activity proposals.

Understanding the effects of proposed activities on resources and issues requires attention to a host of interactions and interrelationships. In addition, terminology can be quite specialized; therefore, a glossary of terms is provided following the List of Preparers at the end of this DEIS.

Recognizing these difficulties, an effort was made to present alternatives in an understandable format. A comparison matrix was developed to display how alternatives differ and are alike. The matrix should also give some insight into the complex ways in which forest ecosystems work. The matrix follows the discussion of the mitigation and monitoring measures.

To help create a sufficiently broad range of alternatives, a "decision spectrum" was developed for component parts of each issue. The spectrum defines a range of acceptable actions related to each issue extending from No Action to the most aggressive action, all consistent with direction in the Hells Canyon NRA CMP. The team then developed themes or philosophies for alternatives and selected appropriate combinations of actions from the decision spectrum for each issue.

From the early stages of the project, members of the timber industry, environmental groups, and other interested citizens met with IDT members, the project director, and the public affairs officer to voice concerns and offer suggestions for alternatives. Written comments to the Forest Supervisor were examined for proposals relevant to the recovery process.

In early December 1988, the general public and Forest Service employees were invited to participate in project open houses held in both Joseph and Baker. Members of the recovery team met on a one-to-one basis with interested individuals to discuss items regarding the formulation of alternatives. The information and suggestions gathered from these various sources were used by the IDT in developing the alternatives.

DESCRIPTION OF THE ANALYSIS PROCESS

The analysis process is designed to inventory resources in the project area, determine their potential, and quantify their interrelationships. Physical inventory is followed by the evaluation of a range of planning strategies by comparing the predicted environmental effects of implementing the alternatives.

Scoping: Many of the topics which were eventually analyzed as issues in this draft EIS were obvious while the Tepee Butte fire still burned. The public expressed a keen interest in the amount and condition of timber which burned as well as a strong concern for the unique character and ecosystems within the Hells Canyon NRA.

Members of the timber industry and environmental groups were involved at early stages and voiced concerns and offered suggestions. Written comments to the Forest Supervisor were carefully examined.

The Interdisciplinary Team (IDT) listed the public issues, management concerns, and resource opportunities which emerged during scoping. Each topic was examined using the following series of questions to determine whether or not the point in question would be a major factor in the analysis process.

1. Has the issue or concern been addressed at a higher level, such as in a previous EIS or through legislative action?

2. Is the issue or concern relevant to and within the scope of the decision being made, and does it pertain directly to the rehabilitation of the environment affected by the Tepee Butte fire?

3. Can the issue or concern be resolved through mitigation (avoiding, minimizing, rectifying, reducing or eliminating, or compensating for the proposed impact)?

4. Can the issue or concern be resolved through project design (addressed in differing alternatives)?

Topics which received a "no" answer to number 1, "yes" to number 2, and "yes" to number 3 or 4 were used in the project analysis, mitigation plans, and the design of the range of alternatives. Those which received a "no" answer were considered but not used in the analysis and alternative designs.

A discussion of the public contact process and a list of the nine key issues which emerged from the scoping process is presented in Chapter 1.

Inventory: Field data collection began in late October 1988 while public scoping was still in its beginning stages. Ordinarily, the scoping process addresses and identifies the type of data needed for the analysis procedure, but in this case timing was critical. The IDT recognized that fall rain and snowstorms were imminent so a data collection plan was assembled, and an inventory team was formed and immediately began its rigorous pursuit of information before the project area became inaccessible.

In addition, specialists reviewed existing resource inventories. Field reconnaissance identified soil characteristics and determined the condition of wildlife habitat. Surveys of streams, cultural resources, range improvements, trails, roads, recreation sites, administrative sites, and viewsheds were conducted. Timber stand examinations were completed and topographic and geologic information was researched to analyze potential road and trail locations and logging system feasibility.

Analysis: Information from the field inventories, aerial photographs, and existing inventories were stored in a computer-based Geographic Information System (GIS). Layers of spatial information included timber stands, soils, wildlife cover, recreation use areas, Visual Quality Objectives, streams, CMP allocations, and others. This spatial information was integrated with data bases containing site-specific information about soil properties, stand conditions, road status, and recreation sites. Computer-linked models for economics and watershed were also developed.

Queries to the GIS allowed the IDT to access information about the spatial relationships of large amounts of data. This enabled site-specific identification of ecologically sensitive areas, potential recovery areas, and potential salvage areas to be aggregated to form alternatives. Further queries to the GIS allowed in-depth site-specific analysis of the alternatives.

The analysis focused on the physical, biological, social, and economic consequences of implementing each alternative. Each alternative was analyzed for its effects on the issues and for displaying variations from the baseline conditions. Additional discussion is expected between this Draft EIS and the Final EIS as new ideas are generated from information received during the public comment period.

Ground verification of the proposed projects will also take place between the Draft and Final EIS to substantiate analysis information or to point out needed updates in information.

Direction Within the Comprehensive Management Plan (CMP) for the NRA

Upon reading the full description of the alternatives the reviewer may be confused about the large disparity in volume proposed for harvest in the alternative above and the action alternatives described below. While there is approximately 252 MMBF gross volume (8.2 MMBF in lands other than those under Hells Canyon NRA management) of timber killed by the fire, much of it is unavailable for harvest due to several constraints.

The first is the law which established the Hells Canyon NRA. The law is very specific in directing that the land is to be managed as a National Recreation Area where, while not excluding timber harvest, recreation opportunities, visual quality, and other resource values are given primary consideration. In part Public Law 94-199 states that:

> .. to assure that the natural beauty, and historical and archaeological values of the Hells Canyon area...together with portions of certain of its tributaries and adjacent lands, are preserved for this and future generations, and that recreational and ecologic values and public enjoyment of the area are thereby enhanced...

See Chapter I for further explanation of PL 94-199.

The Hells Canyon NRA was in part created to assure the area's natural beauty would be preserved for this and future generations.

The second factor affecting the management of the area is the Comprehensive Management Plan (CMP). This plan was prepared as part of the direction of the act. It sets the themes and direction under which the area is to be managed and the types of activities which are compatible. The CMP reads in part:

> ...Do not conduct timber management activities or the gathering of firewood in areas designated Dispersed Recreation/Native Vegetation...
>
> Forage Management Areas...Timber management activities would take place only when determined desirable for wildlife habitat improvement or for recreation or scenic values.
>
> Dispersed Recreation/Timber Management Areas...Manage timber on these areas as part of the regulated component of the Wallowa-Whitman National Forest timber base. Coordinate all timber management activities to assure that ample opportunities for dispersed recreation are available. Give priority to maintaining a variety of tree species and diversity of sizes and age classes.
>
> ...Maximum opening size is two acres if created for timber management purposes. Larger openings may be created for other resource objectives. However, such proposals are to be considered discreetly on a case-by-case basis through the NEPA process.
>
> ...Maintain the 60 percent snag level..., except where snags are a safety hazard.
>
> Manage for representation by TRI (Total Resource Inventory) compartment of five basic successional stages or age classes;...
>
> Retain at least 10 percent of commercial forest land as old growth. Hiding cover...will be maintained at no less then 60 percent of the optimum situation as it relates to size and spacing of forage and cover blocks.
>
> Limit timber harvest roads to the minimum necessary for haul of equipment and logs, consistent with protection of other resources. Emphasize log yarding systems that minimize the need to construct roads. Close timber harvest roads unless needed to meet recreation objectives. All new roads will meet or exceed visual management objectives.
>
> Activities which might affect water quality will be conducted in accordance with "best management practices" as described by the Clean Water Act (PL 95-217) and Forest Service directives.
>
> Visual quality objectives will be met or exceeded within one year following timber sale activities (CMP pages 23-24).

The reader is directed to the Final Environmental Impact Statement and Comprehensive Management Plan for the Hells Canyon National Recreation Area for a full description of this direction.

The third factor which affects timber recovery is the nature of the land and the timber itself. Some areas are reserved from harvest for such things as Stream Side Management Units (SMU), Old Growth stands (OG), wildlife cover, and recreation/administrative use sites. In other situations the timber may not be of a harvestable size or is so scattered or of such a nature that it is uneconomical to harvest or is precluded due to other resource constraints.

Figure II-1 below shows an estimate of the volume of timber killed or severely damaged by the fire in all allocations and within other ownership. For land within Hells Canyon NRA it displays by allocation the number of acres and amount of timber in millions of board feet which has been reserved for specific reasons or may be available for harvest. These estimates are based on queries from the Geographic Information System and are displayed here to help explain the process the Interdisciplinary Team used in evaluating the alternatives.

ALTERNATIVES CONSIDERED BUT NOT GIVEN DETAILED STUDY

In addition to the five alternatives considered in detail in this document, other alternatives were considered but not fully developed for detailed study. Some of these discarded alternatives were designated as B,C,D,E, and F during the preliminary stages of environmental analysis and are identified as such in the process records. A description of these alternatives and the reasons why they were not considered in detail are listed below.

Three alternatives considered removal of the dead and severely damaged trees as mitigation to rehabilitate the visual resource, thus allowing openings greater than two acres. These alternatives were based on the interpretation that the fire had a negative impact on the visual resource and character of the landscape. A fourth alternative was similar to Alternative I in philosophy in that fire was considered a natural occurrence with no negative impact.

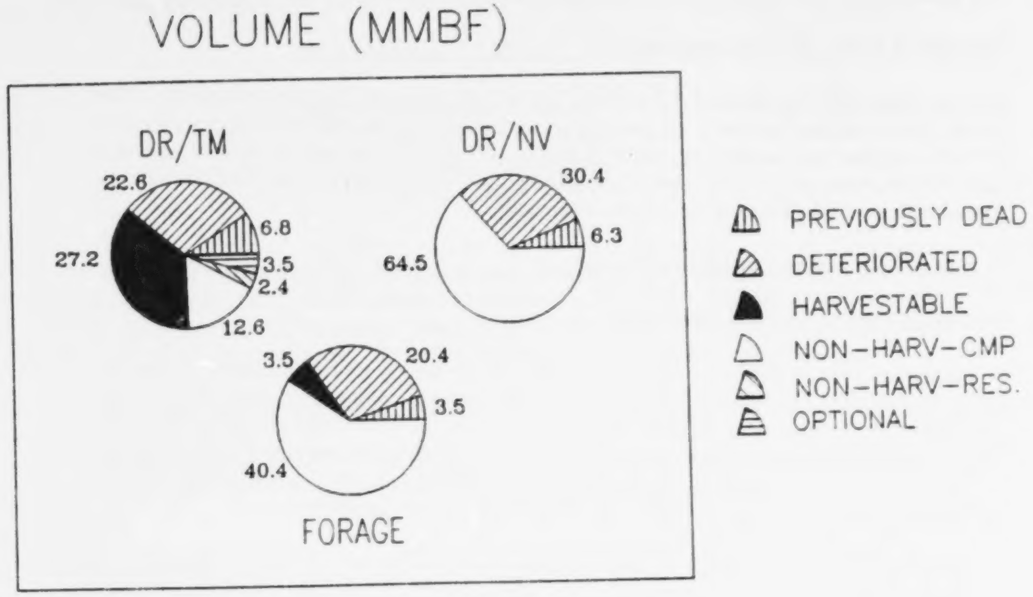
A key factor in this analysis effort concerned a consensus among Forest Service visual resource management experts that wildfire is a naturally occuring event that alters but does not negatively impact the visual quality of a landscape. This consensus also included the conclusion that rehabilitation of the fire effects for the visual resource is not appropriate and not consistent with the direction in the Hells Canyon NRA Comprehensive Management Plan (CMP). Therefore, these alternatives were dropped from further analysis. Portions of these alternatives were modified to become part of the fully developed alternatives.

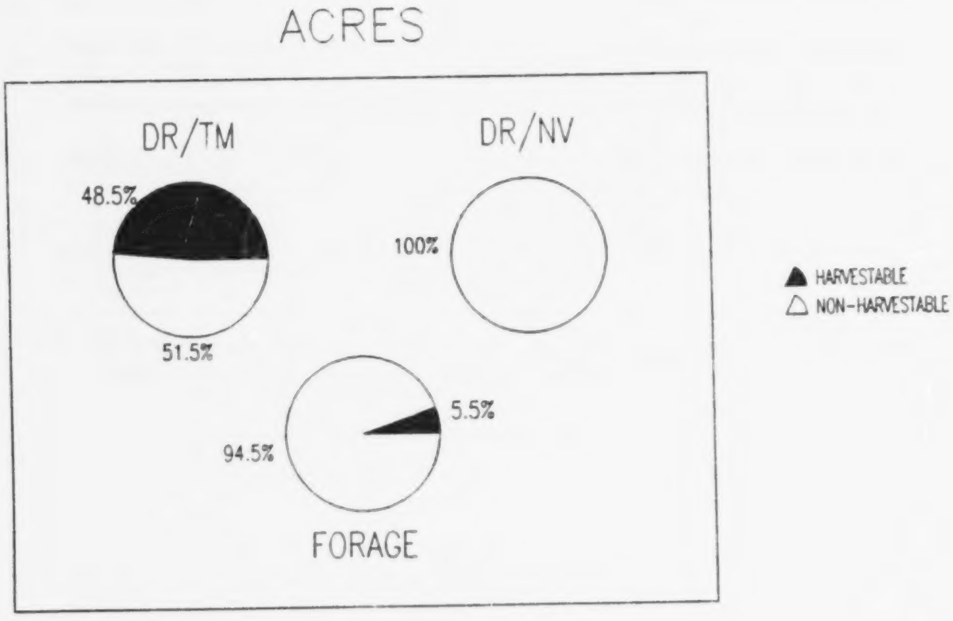
Insect Buildup Alternative

In response to public scoping, an alternative was developed on the premise that there would be a significant buildup of Douglas-fir bark beetles that would reach epidemic proportions and affect timber stands adjacent to the burned area. An analysis by the Forest Service entomologist determined there was a low probability of this happening, but if it did the prescription would be a quarter-mile treatment zone in high risk areas where all susceptible Douglas-fir trees would be removed. This would include all live Douglas-fir except healthy, fast-growing trees less than 150 years of age. The treatment would remove 3.4 MMBF (million board feet) of merchantable timber from 460 acres in the Dispersed Recreation/Native Vegetation (DR/NV) allocation, 1.0 MMBF from 164 acres in the Forage allocation and 10.5 MMBF from 1685 acres in the Dispersed Recreation/Timber Management (DR/TM) allocation for a total of 14.9 MMBF salvable volume.

If fully developed the alternative would likely include other dead and severely damaged timber. The alternative was not fully developed because the risk of an insect epidemic is low and removal of the identified stand component is not fully consistent with visual,

Figure II-1 Harvestable and Non-Harvestable Volume (MMBF) and Acres by Allocation





recreation, wildlife, or watershed objectives contained in the CMP. Refer to the Pumpkin Fire analysis in "Fire Case Studies," Appendix E.

Salvage In Cover Stands Alternative

Another alternative considered but not fully developed is one that would enter some of the wildlife cover stands that were not considered for salvage in Alternative G. Cursory evaluation showed that the resultant reduction in both cover acreage and cover value is inconsistent with direction given in the Hells Canyon NRA CMP. Because of these inconsistencies, the alternative was dropped from further analysis.

Two alternatives were partially developed.

Maximum Timber Salvage Alternative

A "Maximum Timber Salvage" alternative was proposed by timber industry during the scoping process. The alternative provides a benchmark of total salvable volume and associated economics and as such only economics and timber volumes were assessed. This alternative would provide for harvest of all merchantable dead and severely damaged trees. Recreation resources, visual quality, soils, wildlife resources, watershed quality, and fisheries resources would not be prime considerations in this alternative.

The alternative would provide 165 MMBF net merchantable timber for harvest. There would be 52.1 miles of new road construction and 40.8 miles of road reconstruction. All newly constructed roads would be closed or obliterated once the logging was complete.

Estimated volumes by species and by land allocation are displayed in the following table, expressed in million board feet of net merchantable timber:

Land Allocations	Ponderosa Pine	Douglas-Fir Western Larch	Grand Fir Other	Total	Acres Harvested
DR/NV	10.2	36.9	21.7	68.8	9,720
DR/TM	5.7	18.3	26.5	50.5	7,091
Forage	5.4	24.6	16.1	46.1	4,890
Total	21.3	79.8	64.3	165.4	21,701

This alternative would provide for planting trees on harvested units with low potential for attaining minimum stocking levels through natural regeneration within 5 years. The alternative encompasses 5,000 acres of planting.

The economic projections for this alternative are as follows:

Net Stumpage .... ($29.62) /MBF

Present Net Value
Cost ...... 71,705,000.
Benefits .. 70,008,000.
Net ...... (-1,697,000.)

The maximum timber salvage alternative was eliminated from further analysis because it would not meet management direction specified in the CMP. These inconsistencies include disregarding management direction for the visual, recreation and watershed resources, wildlife and fisheries habitat, and direction for the transportation system.

Maximum Timber Salvage While Providing Stream Buffers and Old Growth Alternative

This alternative was identified during the scoping process and is similar to the Maximum Timber Salvage alternative in that economics and salvaging timber volume are emphasized.

This alternative proposal would salvage all dead and severely damaged trees while maintaining a 200 foot no-cut buffer on each side of Class I, II, and III streams. Salvage would occur adjacent to Class IV streams with restrictions on ground disturbance and drainage techniques. Ten percent of the timbered acreage in the DR/TM allocation is set aside for old growth. Beyond this, other wildlife cover needs, recreation resources, and visual quality are given no further consideration.

This alternative would provide 144 MMBF net merchantable timber for harvest. There would be 52.1 miles of new road construction and 40.8 miles of road reconstruction. All newly constructed roads would be closed or obliterated following logging.

Estimated timber salvage harvest volumes by species and land allocation are displayed in the following table, expressed in million board feet net merchantable timber:

Land Allocations	Ponderosa Pine	Douglas-Fir Western Larch	Grand Fir Other	Total	Acres Harvested
DR/NV	8.8	32.1	19.1	60.0	8,252
DR/TM	5.5	17.2	24.7	47.4	6,488
Forage	5.0	20.8	10.7	36.5	4,103
Total	19.3	70.1	54.5	143.9	18,843

This alternative provides for planting trees on harvest units with low potential for attaining minimum stocking levels through natural regeneration within 5 years. The alternative encompasses 4,400 acres of planting.

The economic projections for this alternative are as follows:

Net stumpage .... ($24.05) /MBF

Present Net Value
Cost ...... 61,777,000.
Benefits .. 61,103,000.
Net .... (-674,000.)

This alternative was eliminated from further analysis because it does not meet CMP direction. Inconsistencies include disregard for CMP direction for visual, recreation and wildlife resources, and management of the transportation system.

Amending the Comprehensive Management Plan (CMP) Alternative

Some segments of the public suggested amending the CMP to provide more specific direction for salvaging fire-affected timber within the Hells Canyon NRA. This approach would greatly expand the scope of the project and would mean additional time and cost for analysis and preparing, reviewing, and issuing environmental documents.

The project area is only a small part of the entire Hells Canyon National Recreation Area covered by the CMP (approximately one-eleventh). Revision and amendment of the CMP would require careful analysis of the entire NRA and the time involved in fully analyzing the entire NRA would effectively eliminate any opportunity to salvage the fire-affected timber.

Issuance of a Record of Decision and final Land and Resource Management Plan (Forest Plan) for the Wallowa-Whitman National Forest would be delayed. Under the current proposal the CMP would be adopted as is into the final Forest Plan. The delays associated with amending the CMP are unacceptable. This DEIS will tier to the CMP. Therefore, an alternative that would amend the CMP was not fully developed.

ALTERNATIVE ELEMENTS CONSIDERED BUT NOT USED FOR FINAL ALTERNATIVE DESIGN

Water Quality/Fisheries Considerations

The following water quality/fisheries considerations were not incorporated into alternative design features or differences. These items either have no potential to be significantly changed as a result of alternative design and implementation, or they relate to information that will not be available for a number of years.

Introduced Chemicals for Vegetation Management

Herbicides and insecticides can affect water quality if improperly applied. No site-specific needs for these chemicals have been identified in any of the project alternatives. If a need for these introduced chemicals later becomes apparent, their potential use will be analyzed and evaluated at that time.

Dissolved Oxygen

Atmospheric oxygen dissolved in stream water is an important life requirement for fish and other aquatic organisms. Primarily because of increased stream water temperatures brought about by the wildfire-caused reduction in stream shade, dissolved oxygen levels will be reduced from pre-fire conditions--the warmer the water, the less oxygen it can contain. (See Chapter IV, Water Resources for further explanation.) Also, the expected post-fire increase of organic debris entering streams provides a medium for microorganisms to expand in numbers, and utilize/remove oxygen from the stream water.

Two facets to dissolved oxygen management exist--preventing further decreases and providing for future increases. An alternative action that was considered to prevent decreased oxygen was "Removing dead trees adjacent to perennial streams for the purpose of reducing the amount of needles that will fall into the stream." This measure was not used because it would also raise stream temperatures. Dissolved oxygen levels are more sensitive to water temperature rises than to increased oxygen demand by organisms utilizing organic matter; therefore, the overall effect of dead- and severely-damaged tree removal would still be a decrease of dissolved oxygen. However, the site-specific removal (harvest) of dead and severely damaged trees adjacent to intermittent streams was included in some alternatives.

Provision for future oxygen increases is incorporated into alternative design by prescribing shrub and tree planting within riparian areas for water temperature purposes (stream shading).

ALTERNATIVES CONSIDERED IN DETAIL

The following five alternatives were fully analyzed by the interdisciplinary planning team. A detailed description of the environmental effects of implementing these alternatives is given in Chapter IV, Environmental Consequences.

Alternative A - No Action

This alternative, which is required by the implementing regulations for NEPA, was developed as one end of a range of alternatives and provides a baseline against which all other alternatives can be evaluated.

This alternative would emphasize natural processes instead of management activities for all recovery items. There would be no timber salvage harvest at this time as part of the recovery project. Recovery of the various resources would be the result of natural processes. Pre-fire maintenance activities would continue as scheduled, including but not limited to trail maintenance, road maintenance, visual quality improvements, recreation site improvements, wildlife enhancement, and continued implementation of the Hells Canyon NRA ten-year timber harvest plan.

Grazing would be restricted in the Cold Spring Allotment until the spring of 1990, and in the Jim Creek and Cherry Creek Allotments until the fall of 1990. After this time period has elapsed grazing would continue as permitted before the fire, subject to revised and updated allotment management plans.

1. Recreation

Alternative A would not recover any fire-damaged recreation resources except those which are part of the normally scheduled maintenance and improvement program for trails and recreation sites for the Hells Canyon NRA.

2. Visual Resource

Established Visual Quality Objectives will be met as the natural process is emphasized. Evidence of human-caused fire suppression activities (e.g. firelines) will remain.

3. Water Quality and Fisheries

No ground-disturbing activities would take place under this alternative. Subsequent natural erosion and corrective rehabilitation would take place. Completed post-fire erosion control work (grass seeding and fireline waterbars) would not be expanded.

4. Wildlife Habitat

Changes in wildlife habitat produced by the fire would not be affected by this alternative. The natural succession of vegetative habitat over time would determine habitat conditions and wildlife populations. Current road closures would remain in effect.

5. Long-Term Productivity

Changes in long-term productivity produced by the fire would not be affected by this alternative

6. Vegetation Management

The natural process would determine future vegetation succession within the burn, including riparian areas, except as influenced by Fall 1988 grass seeding.

7. Road Management/Transportation

There will be no new road construction or removal of existing roads from the transportation system under this alternative. Miles of open roads would remain the same. The road density would be 4.37 miles per square mile in the DR/TM allocation, 0.37 miles per square mile in the DR/NV allocation, and 0.26 miles per square mile in the Forage allocation.

8. Rapid Timber Recovery

No timber would be recovered as part of the Tepee Butte Recovery project. Incidental hazard trees would be removed for public safety.

Alternative G

This alternative emphasizes maintaining healthy and diverse (a variety of species composition and age classes) timber stands over time. It also seeks to maintain existing big game cover and re-establish cover that was destroyed or killed by the Tepee Butte wildfire as quickly as possible. Although prescribed treatments would be consistent with CMP management direction for other resources, most recovery efforts would be directed toward vegetation management and wildlife habitat. This alternative treats the maximum amount of acres for vegetative recovery while meeting the CMP constraints for all other resources.

This alternative attempts to maximize salvage while meeting the CMP direction for all resources.

1. Recreation

The ROS (Recreation Opportunity Spectrum) inventory would remain constant. All recreation sites would be recovered to pre-fire conditions, and access routes would be cleared. These sites include 62 dispersed campsites, 8 water sources, and 11 trailheads. High-risk hazard trees at recreation sites in the DR/TM allocation would be salvaged. High-risk hazard trees at sites in the Forage and DR/NV allocations would be felled and made available for recreation use firewood. Fire-damaged recreation sites would be seeded or planted with indigenous grass, shrub, and/or tree species. Tractor lines constructed for fire suppression would be returned to natural repose.

The trail system would be recovered to pre-fire condition. Recovery would require 18.6 miles of normal maintenance, 33.3 miles of heavy maintenance, and 5.9 miles of reconstruction. High-risk hazard trees along trail corridors in the DR/TM allocation would be salvaged where practical. High-risk hazard trees exceeding 24" in diameter would be salvaged where practical in the Forage allocation. Hazard trees less than 24" in diameter in the Forage allocation and all hazard trees in the DR/NV allocation would be cleared from trails after they fall.

Alternative G establishes no new recreation features.

2. Visual Resource

Established Visual Quality Objectives will be met, however there may be some reduction from the existing Visual Condition. Selected human-caused disturbances will be rehabilitated including 20-25 miles of fireline and clean up of selected recreation sites.

3. Water Quality and Fisheries

No trees would be harvested for sale purposes within 200 feet of Class I, II, and III streams. In cases where trails follow streamcourses, some trees may be removed for trail safety and sold. Salvage would occur adjacent to Class IV streams with restrictions for ground disturbance and drainage methods. These restrictions would be used in conjunction with application of Best Management Practices (BMPs) identified in Appendix D.

4. Wildlife Habitat

The emphasis is on maintaining and recovering big game cover. Existing satisfactory cover would be untreated (unharvested). Marginally adequate cover would be treated where there is a high potential of Douglas-fir bark beetle activity resulting in loss of existing cover (388 acres). Artificial regeneration (planting) would take place on 877 acres. This includes 269 acres in the Forage allocation where salvage will occur to lessen the amount of dead material which would eventually be on the ground and could impede wildlife travelways. Once cover has been established, these salvaged areas will more likely be used as travel corridors than the unsalvaged areas since travel will be easier. Salvage will provide financing for reforestation, thus ensuring tree planting for earlier establishment of cover.

Marginal cover, which contains green islands of trees, are at highest risk from Douglas-fir bark beetle attack (see Insects and Diseases, Chapter IV). By sanitizing the dead and severely damaged trees, the remaining live Douglas-fir trees can be protected from a beetle attack. This will maintain the remaining cover value for wildlife.

Snags in all units would be maintained at the 100 percent level. (Thomas et al. 1979). The designated snags would be in the larger diameter classes to promote their longevity.

Areas managed for designated old growth (approximately 715 acres) in the DR/TM allocation will be those providing the best old growth quality. Field verification of candidate old growth stands will contribute 376 acres toward this number.

5. Long-Term Productivity

Compaction and other soil damage would be minimized by implementing BMPs described in Appendix D and mitigation measures. On harvested units large woody debris would be left at a minimum of 5 pieces per acre, 20' long by 12" diameter as available. In addition there would be a minimum of 15-20 plus tons per acre of 3" to 9" diameter woody debris left on site for soil stabilization and nutrient cycling.

6. Vegetation Management

All areas in the DR/TM allocation and selected areas in the Forage allocation that are plantable and have a low probability for natural regeneration would be planted with tree seedlings. These areas are shown on the Alternative G recovery map and comprise 877 acres as mentioned in the wildlife discussion. The time frame for completing the planting would be within 5 years of the completion of harvest operations. It is anticipated gopher baiting will take place on approximately 220 acres of the 877 acres. In riparian zones, 24.2 miles of deciduous vegetation would be planted in selected intensive burn areas. These areas are also shown on the Alternative G recovery map.

7. Road Management/Transportation

This alternative seeks to utilize the least costly transportation system that is consistent with resources and management direction. All road construction would occur in the DR/TM allocation. There would be 3.9 miles of specified road construction added to the existing transportation system, 15.8 miles of road reconstruction, and 1.3 miles of temporary road construction. All temporary roads would be obliterated once logging is complete. Non-road logging systems are emphasized and consist of:

1,432 acres of helicopter yarding with 18 helicopter landing sites proposed,
314 acres of skyline yarding, and
1,674 acres of ground skidding.

There will be 12.4 miles of existing roads removed from the transportation system. This, in conjunction with road closures, would result in an open road density of 1.61 miles per square mile in the DR/TM allocation, 0.16 miles per square mile in the DR/NV allocation and 0.0 miles per square mile in the Forage allocation. A grass mix will be planted on closed roads for forage and visual rehabilitation.

Helicopter logging often provides a means of protecting valuable resources.

8. Rapid Timber Recovery

This alternative provides an estimated 30.6 MMBF of merchantable timber and an estimated 3.5 MMBF of optional timber sale volume. The harvest prescription for all stands in this alternative is a salvage cut (dead and severely damaged). Harvest will increase road accessibility and, over time, allow management to perpetuate healthy and diverse stands of timber.

Alternative H

Alternative H emphasizes rehabilitating elk cover and other wildlife habitat values. At the same time other resource values affected by the fire would be recovered to a moderate degree.

1. Recreation

The ROS inventory would remain constant. All recreation sites would be recovered to pre-fire conditions, and access routes would be cleared. These sites include 52 dispersed campsites, 8 water sources, and 11 trailheads. High-risk hazard trees at recreation sites in the DR/TM allocation would be salvaged where practical. High-risk hazard trees at sites in the Forage and DR/NV allocations would be felled and made available for recreation use firewood. Fire-damaged recreation sites would be seeded or planted with indigenous grass, shrub, and/or tree species. Tractor lines constructed for fire suppression would be returned to natural repose.

The trail system would be recovered to current management objectives. Recovery would require 13.0 miles of normal maintenance, 29.6 miles of heavy maintenance, and 13.2 miles of reconstruction. High risk hazard trees along trail corridors in the DR/TM allocation would be salvaged where practical. High risk hazard trees exceeding 24" in diameter would be salvaged where practical in the Forage allocation. Hazard trees less than 24" in diameter in the Forage allocation and all hazard trees in the DR/NV allocation would be cleared from the trails after they fall.

Alternative H establishes 6 new recreation features. These new features include 5 interpretive viewpoints and 1 interpretive trail. The new trail would total 2.0 miles. In addition to the new features, 3 trailheads would be relocated and 8 trailheads would be consolidated into 4 common sites.

2. Visual Resource

Established Visual Quality Objectives would be met, however there may be some reduction from the existing Visual Condition. Selected human-caused disturbances will be rehabilitated including approximately 20-25 miles of fireline and clean up of selected recreation sites.

3. Water Quality and Fisheries

No trees would be harvested for sale purposes within 200 feet of Class I, II, and III streams. In cases where trails follow streamcourses, some trees may be removed for trail safety and sold. Salvage would occur adjacent to Class IV streams with restrictions for ground disturbance and drainage methods. These restrictions would be used in conjunction with application of BMPs identified in Appendix D.

4. Wildlife Habitat

The emphasis is on maintaining and recovering big game cover. Existing satisfactory cover would be untreated and marginal cover would only be treated where there is a high potential of Douglas-fir bark beetle activity resulting in loss of existing cover. Approximately 280 acres have been identified that may require treatment.

Snags in all units would be managed at the 100 percent level. (Thomas et al. 1979) for all harvest units. The snags designated would be in the larger diameter classes to promote longevity.

Areas managed for designated old growth (approximately 715 acres) in the DR/TM allocation will be those providing the best old growth quality. Field verification of candidate old growth stands will contribute 376 acres toward this number. Cover and accelerated succession to an old growth condition would be assisted by artificially regenerating (planting) 439 acres, including 269 acres in the Forage allocation as shown on Alternative H recovery map.

5. Long-Term Productivity

Compaction and other types of soil damages would be minimized by implementing BMPs described in Appendix D and mitigation measures. On harvested units large woody debris would be left at a minimum of 5 pieces per acre, 20' long by 12" in diameter as available. In addition there would be a minimum of 15-20 plus tons per acre of 3" to 9" diameter woody debris left for soil stabilization and nutrient cycling.

6. Vegetation Management

Selected areas in the DR/TM allocation and selected areas in the Forage allocation that are plantable and have a low probability for natural regeneration would be planted. These areas are shown on the Alternative H recovery map and comprise 439 acres as mentioned in the wildlife discussion. The time frame for completing the planting would be within five years of the completion of harvest operations. It is anticipated that gopher baiting will take place on approximately 110 acres of the 439. Salvage logging would occur on 170 of these acres. The remaining 269 acres would be planted without salvage. In riparian zones 3.4 miles of deciduous vegetation would be planted in selected intensive burn areas. These areas are also shown on the Alternative H recovery map.

7. Road Management/Transportation

All road construction would occur in the DR/TM allocation. There would be 2.7 miles of specified road construction added to the existing transportation system, 15.6 miles of road reconstruction and 0.4 miles of temporary road construction. All temporary roads would be obliterated once logging is complete. Non-road logging systems are emphasized and consist of:

376 acres of helicopter yarding with 18 helicopter landing sites proposed,
79 acres of skyline yarding, and
523 acres of ground skidding.

There will be 12.4 miles of existing roads removed from the transportation system. This, in conjunction with road closures, would result in an open road density of 1.61 miles per square mile in the DR/TM allocation, 0.16 miles per square mile in the DR/NV allocation, and 0.0 miles per square mile in the Forage allocation. A grass mix will be planted on closed roads for forage and visual rehabilitation.

8. Rapid Timber Recovery

This alternative would provide an estimated 7.5 MMBF of merchantable timber and an estimated 0.5 MMBF optional volume. The harvest prescription for all stands in this alternative is a salvage cut (dead and severely damaged). On acres harvested there will be increased accessibility which, over time, will allow management to perpetuate healthy and diverse stands.

Alternative I

This alternative emphasizes recovering and enhancing recreation and visual resources. Treatment will be consistent with the physical and social setting described in the CMP.

1. Recreation

The ROS inventory would remain constant. All recreation sites would be recovered to pre-fire conditions, and access routes would be cleared. These sites include 62 dispersed campsites, 8 water sources, and 11 trailheads. High-risk hazard trees at sites in the DR/TM allocation would be salvaged where practical. High-risk hazard trees at sites in the Forage and DR/NV allocations would be felled and made available for recreation use firewood. Fire-damaged recreation sites would be seeded or planted with indigenous grass, shrub, and/or tree species. Tractor lines constructed for fire suppression would be returned to natural repose.

The trail system would be recovered to current management objectives. Recovery would require 13.0 miles of normal maintenance, 29.6 miles of heavy maintenance, and 13.2 miles of reconstruction. High-risk hazard trees along trail corridors in the DR/TM allocation would be salvaged where practical. Hazard trees in the Forage and DR/NV allocations would be cleared from the trails after they fall.

Alternative I establishes 16 new recreation features. These new features include 11 interpretive viewpoints, 2 trailheads, and 3 interpretive trails. The new trails would total 7.1 miles. In addition to the new features, 3 trailheads would be relocated and 8 trailheads would be consolidated into 4 common sites.

2. Visual Resource

Established Visual Quality Objectives would be met. Selected areas (303 acres) usually located in the foregrounds of roads, dispersed camps, trailheads and springs where the mortality rate was high would be planted with native trees and/or shrub species, controlling and enhancing recovery in these intensive use areas. These plantings would also provide increased visual variety by adding color, spring bloom, form, wildlife use, and stand structure. Selected human-caused disturbances will be rehabilitated including approximately 20-25 miles of fireline and cleanup of selected recreation sites.

3. Water Quality and Fisheries

No trees would be harvested for sale purposes within 200 feet of Class I, II, and III streams. In cases where trails follow streamcourses, some trees may be removed for trail safety and sold. Salvage would occur adjacent to Class IV streams with restrictions for ground disturbance and drainage methods. These restrictions would be used in conjunction with application of BMPs identified in Appendix D.

4. Wildlife Habitat

Changes in wildlife habitat produced by the fire would not be altered by this alternative. The natural succession of vegetative habitat would determine habitat conditions and wildlife populations. Selected road closures would also help to increase the Elk Habitat Effectiveness Index. Planting trees on 303 acres will accelerate cover development.

5. Long-Term Productivity

Changes in long-term productivity produced by the fire would not be altered by this alternative.

6. Vegetation Management

Selected areas would be planted with grass, trees, and or/shrubs for visual enhancement. These areas are shown on the Alternative I recovery map and comprise 303 acres. In riparian zones, 24.2 miles of deciduous vegetation would be planted in some severely fire-damaged areas. These areas are also shown on the Alternative I recovery map.

7. Road Management/Transportation

There will be no new road construction in this alternative, however 1.1 miles of road reconstruction is planned to improve access in the project area. 11.3 miles of roads would be removed from the transportation system. This, in conjunction with road closures, would result in an open road density of 2.36 miles per square mile in the DR/TM allocation, 0.33 miles per square mile in the DR/NV allocation, and 0.0 miles per square mile in the Forage allocation.

8. Rapid Timber Recovery

Only incidental dead and severely damaged trees (up to 1 MMBF) will be cut in conjunction with enhancement projects. These may be sold through the small sales program from decks.

Alternative J

This alternative blends the degree of recovery of the resources to minimize effects to wildlife, visual, and recreation resources while allowing harvest where effects are minimal. An intermediate level of recovery and enhancement is employed.

1. Recreation

The ROS inventory would remain constant. All recreation sites would be recovered to pre-fire conditions, and access routes would be cleared. These sites include 52 dispersed campsites, 8 water sources, and 11 trailheads. High-risk hazard trees at recreation sites in the DR/TM allocation would be salvaged where practical. High-risk hazard trees at sites in the Forage and DR/NV allocations would be felled and made available for recreation use firewood. Fire-damaged recreation sites would be seeded or planted with indigenous grass, shrub, and/or tree species. Tractor lines constructed for fire suppression would be returned to natural repose.

The trail system would be recovered to current management objectives. Recovery would require 13.0 miles of normal maintenance, 29.6 miles of heavy maintenance, and 13.2

miles of reconstruction. High-risk hazard trees along trail corridors in the DR/TM allocation would be salvaged where practical. High-risk hazard trees exceeding 24" in diameter would be salvaged where practical in the Forage allocation. Hazard trees less than 24" in diameter in the Forage allocation and all hazard trees in the DR/NV allocation would be cleared from the trails after they fall.

Alternative J establishes 6 new recreation features. These new features include 5 interpretive viewpoints and 1 interpretive trail. The new trail would total 2.0 miles. In addition to the new features, 3 trailheads would be relocated and 8 trailheads would be consolidated into 4 common sites.

2. Visual Resource

Established Visual Quality Objectives will be met. Units located in the foreground of Roads 46 and 4680 would have a 300' no-cut buffers and cutting units located in the foreground of recreation sites (dispersed camps, trailheads, trails and springs) would have no-cut buffers of varying widths. The purpose of these buffers is to maintain the stand structure of the characteristic landscape and screen potential impacts within the remainder of the unit and units beyond.

Selected human-caused disturbances will be rehabilitated including approximately 20-25 miles of fireline and clean up of selected recreation sites.

3. Water Quality and Fisheries

No trees would be harvested for sale purposes within 200 feet of Class I, II, and III streams. In cases where trails follow streamcourses, some trees may be removed for trail safety and sold. Salvage would occur adjacent to Class IV streams with restrictions for ground disturbance and drainage methods. These restrictions would be used in conjunction with application of BMPs identified in Appendix D.

4. Wildlife Habitat

The emphasis is on maintaining and recovering big game cover. Existing satisfactory cover would be untreated. Marginal cover would be treated where there is a high potential of Douglas-fir bark beetle activity resulting in loss of existing cover (388 acres). Areas where there is no seed source remaining and which are suitable for planting would be artificially regenerated (877 acres). This includes 269 acres in the Forage allocation, and 608 acres in the DR/TM.

Snags, in all units would be maintained at the 100 percent level (Thomas et al. 1979) for all harvest units. The snags marked will be at the larger end of the diameter class to promote longevity.

Areas managed for designated old growth (approximately 715 acres) in the DR/TM allocation will be those providing the best old growth quality. Field verification of candidate old growth stands will contribute 376 acres toward this number.

5. Long-Term Productivity

Compaction and other soil damage would be minimized by implementing BMPs described in Appendix D and mitigation measures. On harvested units large woody debris would be left at a minimum of 5 pieces per acre, 20' long by 12" in diameter as available. In addition there would be a minimum of 15-20 plus tons per acre of 3" to 9" diameter woody debris for soil stabilization and nutrient cycling.

6. Vegetation Management

All areas in the DR/TM allocation and selected areas in the Forage allocation that are plantable and that have a low probability for natural regeneration would be planted. These areas are shown on the Alternative J recovery map and comprise 877 acres as mentioned in the wildlife discussion. It is anticipated gopher baiting will take place on 220 acres of the 877 acres. Salvage logging would occur on 608 of the acres. The remaining 269 acres would be planted without being salvaged. The time frame for completing the planting would be within five years of the completion of harvest operations. In riparian zones, 24.2 miles of deciduous vegetation would be planted in selected intensely burned areas. These areas are also shown on the Alternative J recovery map.

7. Road Management/Transportation

This alternative seeks to utilize the most economic transportation system that is consistent with the resources and management direction. All road construction would occur in the DR/TM allocation. There would be 3.9 miles of specific road construction added to the transportation system, 15.8 miles of road reconstruction and 1.3 miles of temporary road construction. The temporary roads will be obliterated once logging is complete. Non-road logging systems are emphasized and consist of:

> 1,059 acres of helicopter yarding and 18 helicopter landing sites proposed,
> 311 acres of skyline yarding, and
> 1,392 acres of ground skidding.

There will be 12.2 miles of existing roads removed from the transportation system as shown on the Alternative J map. This, in conjunction with road closures, would result in an open road density of 2.01 miles per square mile in the DR/TM allocation, 0.16 miles per square mile in the DR/NV allocation and 0.0 miles per square mile in the Forage. A native species mix will be planted on closed roads for forage and visual rehabilitation.

8. Rapid Timber Recovery

This alternative provides an estimated 22.6 MMBF of merchantable timber and an estimated 1.1 MMBF of optional volume. The harvest prescription for all stands in this alternative is a salvage cut (dead and severely damaged). Harvest will increase accessibility and, over time, allow management to perpetuate healthy and diverse stands of timber.

ELEMENTS COMMON TO ALTERNATIVES G THROUGH J

The length of alternative descriptions was reduced by listing below the activities which will be performed in all action alternatives (G-J). Elements which do not apply to all action alternatives are listed in the appropriate individual alternative descriptions.

Additionally, applicable management direction contained in National, Regional, and Forest standards, guidelines, and policies will be applied to any recovery project that may be implemented. This generalized direction is contained in laws, regulations, the Forest Service manual system, and higher order plans (e.g. Draft Forest Plan, CMP), and therefore is not repeated in this DEIS.

Mitigating Measures

Mitigating measures are defined as actions taken to avoid, minimize, reduce, eliminate, or rectify the impacts of management activities. These measures are designed to meet or exceed legal requirements and management direction and policies. Mitigating measures include protection of threatened and endangered species habitat, wildlife and riparian habitat, water quality, and soil, cultural, recreation, and visual resources. Listed below are the mitigation measures common to all action alternatives. Each mitigation is given a reliability index rating (for an explanation of the reliability index rating system see Appendix D). Except as otherwise stated, the reliability rating index for each mitigation is based on a combination of one or more factors such as research, professional judgment, historically accepted practice, and past experience.

Recreation Resources

1. Dispersed recreation sites, including established camps, spring developments, and public trailheads will be delineated on the ground and on project maps prior to salvage operations. Protection measures will include individual tree marking, directional tree felling, and skidding restrictions to minimize disturbance of these sites. The objective is to protect the sites from the adverse impacts of timber salvage and to maintain a quality recreation setting. The project recreation planner, in cooperation with the timber marking foreman, will be responsible for delineating the sites and marking the trees. The Contracting Officer will ensure contractor compliance. The reliability index rating for this mitigation is good.

2. All salvage logging operations shall be prohibited during periods of high recreation use. These periods include Fourth of July and Labor Day holidays and their associated weekends, and the two days before and after the opening days of rifle deer and elk hunting seasons (total of five days for deer and five days for elk seasons). The objective is to minimize conflicts between hunters and logging contractors and to enhance opportunities for quality hunting experiences. The Contracting Officer will be responsible for entering the mitigation in the sale contract and for ensuring compliance from the contractor. The reliability index rating for this mitigation is excellent.

3. Timber purchasers will provide for safety of the public on trails by posting warning signs and/or guards and by other methods such as closing trails during salvage operations. The objective is to protect the public from hazards associated with salvage operations. The logging contractor will be responsible for implementing the mitigation. The Contracting Officer will ensure compliance from the contractor. The reliability index rating for this mitigation is good.

4. Trails determined to be dangerous to recreationists and recreation livestock will be closed until recovery project trail maintenance is completed and the identified hazards are corrected. The objective is to protect the public from hazards such as unstable tread segments and falling trees along trail corri-

dors. The Area Ranger will be responsible for recommending closures to the Forest Supervisor who will issue a closure order. The Area Ranger will ensure compliance from the public. The reliability index rating for this mitigation is fair.

5. Trails and other recreation use areas will be identified as improvements for protection on any recovery project work contracts. The objective is to protect the sites from any adverse impacts of project work contracts. The project recreation planner, in cooperation with the Area Ranger and project work leader, will be responsible for identifying these sites as projects are scheduled. The Contracting Officer will ensure compliance from the contractor. The reliability index rating for this mitigation is good.

6. Personal use firewood cutting will be limited to designated areas. Designated areas will be identified after evaluation to determine if firewood cutting would be compatible with recreation, visual, wildlife, and soils objectives. Monitoring will determine continued compatibility. The objective is to ensure that personal use firewood cutting is managed compatibly with other resources. The Area Ranger will be responsible for developing a personal use firewood cutting plan. The Area Ranger will ensure compliance from the public. The reliability index rating for this mitigation is good.

Visual Quality

1. Stumps will be cut flush in the foregrounds along Roads 46 and 4680, along trails, and around identified recreation sites, including dispersed camps. All other areas will use the standard 12" or 1/3 of stump diameter maximum stump height to reduce visual impacts. These stump height requirements will reduce the visual impact of salvage harvest activities. The Timber Sale Purchaser will be responsible for implementation. The reliability index rating of this mitigation measure is excellent.

2. Appropriate slash treatments (hand-piling or grapple-machine piling) will be used in foreground areas to reduce the visual impacts of harvest activities. The Timber Sale Purchaser will be responsible for implementation. The reliability index rating of this mitigation is excellent.

3. Individual tree marking in Partial Retention Foreground areas will be employed under the direction of a Landscape Architect to ensure that designated Visual Quality Objectives will be met. The Forest Service is responsible for implementation. The reliability index rating of this mitigation is good.

4. Maximum opening size will be 2 acres. Live green trees and those fire-killed trees that are unmerchantable will remain to provide crown cover and maintain a continuous texture with no openings or only small openings. When these components are not sufficient to meet the 2-acre maximum opening constraint, additional merchantable fire-killed trees will be left standing to meet the criteria. The Forest Service is responsible for implementation. The reliability index rating of this mitigation measure is unknown, however, is expected to be good. Monitoring will be required to evaluate effectiveness. This mitigation measure is based on a combination of professional judgment and CMP direction.

5. Cutting units harvested by skyline cable systems will be adjusted to reduce the negative visual impacts of skyline corridors and geometric unit shapes. This will include, where needed, limiting corridor widths to 12 feet with the use of rub trees and not harvesting some trees along the boundary of the unit. The Timber Sale Purchaser is responsible for implementation. The reliability index rating of this mitigation measure is good.

6. Helicopter landings will be located to minimize the need for large cut and fill slopes to minimize the unacceptable visual impacts of salvage harvest activities. The Forest Service is responsible for implementation. The reliability index rating of this mitigation measure is excellent.

Water Quality/Fisheries (Best Management Practices)

"Best Management Practices" (BMPs) and additional prescriptions specific to the Tepee Butte Recovery Project Area are mitigating measures intended to protect water, soil, and riparian quality within the project area and downstream in the Grande Ronde and Snake Rivers. BMP design incorporates the results of all previous environmental analysis work undertaken for this DEIS, including utilization of watershed research and results conducted in similar areas. The BMPs are described in Appendix D under the following subheadings:

-- Preventing rain-caused peakflow increases and associated sediment and turbidity production.
-- Preventing riparian area stream shade decrease and water temperature increase.
-- Minimizing disruption of Class IV Streamside Management Units.
-- Minimizing soil erosion increases.
-- Minimizing damage to riparian area shrubs and new trees by livestock.

Wildlife Resources

1. Habitat for snag- and cavity-dependent wildlife will be maintained at the 100 percent habitat potential for all CMP land use allocations. This clarifies the CMP direction for the area. The Forest Service is responsible for compliance. The reliability index rating for this mitigation is good. The reliability rating is based on a combination of past experience in dealing with mitigation measures and CMP direction.

2. A 100-foot no-cut buffer will be maintained around all unmapped springs. These springs will be located and added to maps for future management information. The objective is to identify and protect unique wildlife habitat areas. The Forest Service is responsible for compliance. The reliability index rating for this mitigation is excellent.

3. Areas providing the best old-growth conditions will be designated and maintained for management as old growth. A total of ten percent of the timbered areas in the DR/TM allocation will be identified cooperatively by the Forest Service and the Oregon Department of Fish and Wildlife (ODF&W) for this purpose. The objective is to provide suitable habitat for wildlife species that prefer old-growth habitat. The Forest Service, in cooperation with ODF&W, is responsible. The reliability index rating for this mitigation is excellent.

4. Where available, uncharred, solid, dead and down logs greater than 20 feet in length and greater than 12 inches diameter will be maintained at a minimum of five pieces per acre. Additional logs with little or no commercial value can also be left on site. The objective is to provide habitat for a variety of wildlife species and to maintain soil productivity. The Contracting Officer is responsible for entering this mitigation in the sale contract and ensuring compliance from the contractor. The reliability index rating for this mitigation is excellent.

5. Protect cliffs and talus slopes as unique habitat areas for wildlife by placing a 100 foot (but not less than one acre) undisturbed buffer around these sites. The objective is to protect and maintain a unique habitat type which is used by a variety of wildlife species (e.g. peregrine falcon). The Forest Service is responsible for compliance. The reliability index rating for this mitigation is excellent.

6. Protect all active goshawk, Cooper's hawk and sharp-shinned hawk nest sites from May 1 to August 31. Provide a 30-acre no-cut (undisturbed) buffer around active nest site areas for goshawks, a 25-acre buffer for Cooper's hawks, and a 15-acre buffer for Sharp-shinned hawks. The objective is to protect the remaining numbers of these species since a large amount of their habitat has been lost. The Forest Service is responsible for compliance. The reliability index rating for this mitigation is good.

7. Frog Pond on the Cold Spring Road (4690) will be made a special wildlife area (approximately 5 acres) by rehabilitating and exclosing (keeping out) livestock and human activity from the majority of the pond. Livestock watering will be provided for at the site. The objective is to enhance wildlife use by creating a unique habitat area. The Forest Service is responsible for compliance. The reliability index rating for this mitigation is excellent.

8. Construct up to 100 large raptor nest platforms, and place 100 kestrel nest boxes and 200 small nest boxes to mitigate the effect of the fire and salvage operations. Locations will be near harvest units to encourage rodent control by raptors. The objective is to prevent rodent damage to conifer tree seedlings. The Forest Service is responsible for compliance. The reliability index rating for this mitigation is good.

9. Seasonal surveys timed and designed for optimum detection of peregrine falcon nesting will be conducted annually. If nest sites are found, appropriate coordination with the US Fish and Wildlife Service and mitigation will take place.

Vegetation Management

1. Protect residual timber stands from unnecessary damage according to contract special provisions. This includes unharvested dead trees. The objectives are to meet wildlife cover and visual management goals. Also, in the case of residual green trees, the objective is to maintain an undamaged seed source and growing stock level. The Forest Service is responsible for compliance. The reliability index rating for this mitigation is good.

2. Timber stands on suitable lands which are selected for harvest will be reforested. This would be accomplished by combinations of natural regeneration

and hand planting after detailed silvicultural examinations are conducted and prescriptions prepared. The objective is to restore the land to pre-fire productivity levels for all resource values. The Forest Service is responsible for compliance. The reliability index rating for this mitigation is good.

Transportation Management

1. All roads designated "closed" on the Road Management Plan (Appendix K) and used for timber harvest will have an appropriate closure device in effect during periods of non-use, including weekends, holidays, and after daily operations. The objective is to implement the road closure plan to lessen the amount of vehicle harassment to wildlife. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is excellent.

2. Road closure devices will be placed at an appropriate location and may require portions of fences on either side as extensions of the closure device to ensure effectiveness. The devices will be out of sight of Roads 4680 and 46 where practical. The objective is to ensure that the closures will be effective and will meet Visual Quality Objectives. The Forest Service and timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is excellent.

3. All road closure devices associated with timber salvage shall be in place prior to logging. The objective is to limit vehicle harassment of wildlife. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is excellent.

4. Additional road closures needed for complete implementation of the Road Management Plan identified in the selected alternative will take place within 30 days of the date the Record of Decision is signed. Closures may be in the form of a posted regulation until such time as physical barricades are installed. The objective is to implement the road closure plan to lessen the amount of vehicle harassment to wildlife. The Forest Service is responsible for compliance. The reliability index rating for this mitigation is good.

5. If a closure is waived for logging operations, transportation of guns, weapons, unauthorized people, or game animals during the closure period is prohibited. Waivers for logging operations or administrative use will not be granted during periods of high recreation use except for emergencies. These periods will include the Fourth of July, the Labor Day holiday and associated weekends and the two days before and after the opening days of rifle deer and elk seasons (total of five days for deer and five days for elk seasons). The objective is to ensure that no conflicts will arise from the use of waivers. The Forest Service is responsible for compliance. The reliability index rating for this mitigation is good.

6. All temporary roads will be sub-soiled with a winged subsoiler. Cut banks will be filled, berms smoothed, and the land otherwise restored to original form and made as naturally appearing as possible. These roads will be seeded with a grass and/or shrub mixture. The objective is to restore temporary roads to a natural repose and to restore the land's productivity. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is good.

7. All new roads will be scarified and seeded following use. The objectives are to prevent erosion, increase productivity, and meet visual resource standards. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is good.

8. Cut banks and fill slopes will be revegetated on all road and landing construction sites. The objectives are to stabilize soils and reduce potential erosion, and to meet visual resource standards. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is excellent.

Logging Operations

1. No log landings are permitted on Roads 46 or 4680 unless approved by the Hells Canyon NRA Ranger. Landings will be located so they will not detract from the visual resource. The purpose is to meet visual resource objectives along Roads 46 and 4680. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is good.

2. Additional temporary roads other than those shown in the Final EIS logging plan will be constructed only if approved by the Hells Canyon NRA Ranger. The objectives are to meet CMP direction that emphasizes non-roaded logging systems, and to meet visual resource objectives. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is good.

3. No temporary roads will begin from Road 46, and only those temporary roads shown in the Final EIS logging plan for Road 4680 may begin from Road 4680. The purpose is to meet visual objectives. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is excellent.

4. The residual stands, including dead trees, will be protected from unnecessary damage according to contract special provisions. Directional felling is required away from all streams, including Class IV, and away from all other improvements, trails, cultural resource sites, and hunter camps. The objective is to protect resource values. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is fair.

5. Mechanical harvest is restricted to those machines (such as feller/bunchers) having shears or saws attached to booms, the boom being at least 30 feet long. The objective is to protect the soil resource from excessive compaction. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is excellent.

6. No whole-tree yarding will be permitted. Limbs on logs that may do damage to forest values (soils, water, visual, recreation or standing timber) will be severed before the logs are skidded. All limbs and tree tops are to remain in place or be scattered over the unit. The exception to the above are units requiring piling of slash concentrations. The objectives are to protect the residual trees (including dead), and to protect the soils. The Forest Service

and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is excellent.

7. Skidding direction shall be away from Roads 46 and 4680, and away from water and trails where possible. The objective is to protect visual, water, and recreation resource values. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is good.

8. Log landing size for tractor and cable operations will be kept to a minimum size of 0.15 acres or less unless approved by the Hells Canyon NRA Ranger. Landing size for helicopter units will be kept to 1 acre or less and any change in location from logging plan locations will be approved by the Area Ranger. The objective is to protect soil and visual resource values. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is fair.

9. Log skidding machines will be restricted to designated skid trails. The objective is to protect soil and water resources. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is good.

10. Logging skid trails will be approved in advance of felling. This is for maximum protection of the remaining trees for visual quality and also for protection of soils and water. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is fair.

11. Landings and skid trails will be scarified with a winged ripper (subsoiler) or equivalent to loosen compacted soil surfaces. The objective is to restore soil friability and infiltration capacity. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is good.

12. Existing down logs or trees will be bucked and removed from skid trails rather than pushed or pulled in their entirety by machines. The objectives are visual, water and soil protection. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is good.

13. No more than three skid trails shall enter a landing unless approved by the Hells Canyon NRA Ranger. The objective is soil and water protection. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is good.

14. Where it would result in a reduction of skid trails, skidding on unsurfaced Maintenance Level 1 and 2 roads is encouraged if road drainage is maintained. The objective is to minimize soil damage by reducing the number of skid trails. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is good.

Other Resource Mitigations

1. Standard provisions to protect significant cultural resources would be included in timber sale, road construction, or other work contracts. Prior to ground-

disturbing activities, field reconnaissance would be completed to identify and protect cultural resource sites. For the purposes of cultural resources, avoidance of the sites is a mitigating measure. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is excellent.

2. Mitigation in the form of a data recovery plan would be designed for fire-killed or injured culturally scarred trees. Some of these trees were affected by the fire, and in order to recover information from this resource that would otherwise be lost, this plan would be implemented once approved by the Oregon State Historic Preservation Office and the Advisory Council on Historic Preservation. The Forest Service is responsible for compliance. The reliability index rating for this mitigation is excellent.

3. Mitigation in the form of a data recovery plan would be designed for all other significant cultural resource sites where impacts from recovery projects are unavoidable, or where impact has occurred as a result of the fire suppression activities. The Forest Service is responsible for compliance. The reliability index rating for this mitigation is excellent.

4. Standard provisions to protect mining claim improvements; threatened, endangered, and sensitive plant and animal species; and land subdivision survey monuments and section corner locations would be included in timber sale/road construction contracts. Prior to ground-disturbing activities, field reconnaissance would be completed to identify these areas. The Forest Service and the timber sale purchaser are responsible for compliance. The reliability index rating for this mitigation is excellent.

Non-Mitigating Measures

The following management activity is common to all of the alternatives other than No Action. It is not a mitigating measure in that it is not designed to counteract any negative effects expected as a result of implementing the action alternatives. The objective is to facilitate rapid recovery of riparian areas from the effects of the wildfire.

Test plots will be installed to determine the effects upon riparian shrubs from browsing by deer, elk, and domestic livestock. The information gained from the test plots will be used to guide future shrub re-establishment projects. An explanation of this riparian shrub re-establishment strategy is written in Appendix H.

Monitoring

The project area will be monitored to ensure prescribed mitigating measures and Best Management Practices (BMPs) are implemented, to determine the effectiveness of these measures at meeting resource objectives, to measure the effects of management activities on various resources, and to document the overall fire recovery rate of the project area. Monitoring results will also be used to determine the degree of compliance with regulations and standards.

A monitoring plan outline for the project analysis area has been developed. This outline will be fully developed between the Draft EIS and the Final EIS.

The following types of monitoring are identified in this plan:

1. Implementation - Are mitigation measures and BMPs being implemented as planned?
2. Effectiveness - Did mitigation and protection measures perform as predicted?
3. Validation - Were assumptions about resource effects accurate?

If monitoring shows that mitigation measures or BMPs are not being implemented as planned or are not being effective in meeting resource objectives, activities will cease or be modified to correct problems.

Recreation Resources

Ensure that recreation sites, including hunter camps, spring developments, interpretive sites, and trailheads are delineated on the ground and on project maps.
TYPE: Implementation and Effectiveness

Ensure that recreation sites and trails are protected from felling and skidding impacts.
TYPE: Implementation and Effectiveness

Ensure that salvage operations are discontinued during identified high use periods.
TYPE: Implementation

Ensure that contractors are providing for public safety on trail corridors.
TYPE: Implementation

Ensure that recreational firewood cutting does not exceed the ROS setting criteria.
TYPE: Implementation, Effectiveness, and Validation

Ensure that hazard trees at recreation sites and along trails are evaluated for appropriate disposition.
TYPE: Implementation

Ensure that spring developments meet sanitation standards.
TYPE: Implementation and Effectiveness

Visual Resource

Measure cumulative effects assumptions with respect to Remaining Crown Density, Removed Tree (Stump) Density and Partial-cut Maximum Disturbance thresholds to ascertain to what level Visual Quality Objectives were met on a viewshed basis.
TYPE: Validation

Ensure maximum 2-acre opening criterion is met. This will be evaluated during layout, marking and logging operations; and following harvest.
TYPE: Implementation/Effectiveness

Ensure foreground partial retention Visual Quality Objectives are met along roads and trails and around recreation sites. This will be evaluated during layout, marking and logging operations; and after harvest.
TYPE: Implementation/Effectiveness.

Watershed

Measure sheet and rill erosion on harvested and unharvested stands. This is to determine if increased erosion rates are associated with wildfire conditions, and to determine if increases in surface erosion related to timber harvest activities are measurable.
TYPE: Effectiveness, Validation

Determine if crossdrains placed on skid trails and dragtrails are properly located and effective in preventing erosion.
TYPE: Implementation, Effectiveness.

Measure stream channel erosion, deposition, bedload, large woody material, and vegetation associated with changes due to wildfire only and compare these values to changes related to timber harvest.
TYPE: Validation.

Assess the accuracy of water temperature model predictions, evaluate vegetative shade recovery and determine impacts on beneficial downstream uses.
TYPE: Effectiveness, Validation.

Determine rate of sediment loading and the amount of turbidity increase during periodic runoff events. Determine sources of sedimentation by instream sampling and watershed surveys to validate sediment prediction model. Determine effectiveness of BMP's in controlling harvest-related increases in turbidity and suspended sediment.
TYPE: Effectiveness, Validation.

Determine if road design, location, and construction meet soil and water objectives and if retention structures are effective in catching and storing runoff and sediment.
TYPE: Implementation, effectiveness.

Determine if stream buffer widths for Class I, II, III streams were properly located and implemented during logging operations.
TYPE: Implementation.

Fish

Monitor fish populations in Cook Creek annually for 10 years to determine if these populations are reaching levels low enough to warrant emergency measures to maintain viable populations.
TYPE: Validation

Wildlife

Annual monitoring to determine suitability and occupancy of designated Old Growth areas for pileated woodpeckers, goshawks, northern three-toed woodpeckers and black-backed three-toed woodpeckers.
TYPE: Validation

Annual monitoring of selected Old Growth areas in DR/TM to determine rate of recovery and changes due to fire.
TYPE: Validation

Elk and deer hunter success will be monitored annually to maintain target herd numbers. This will be done by the Oregon Department of Fish and Wildlife.
TYPE: Effectiveness, Validation

Vegetation Management

Stands harvested and regenerated by natural or artificial methods will be monitored to assure regeneration success. Regenerated stands will be monitored by stocking surveys the first and third year following planting, and later years as needed. Establishment exams will be performed when average stand height is 4.5 feet tall.
TYPE: Effectiveness.

Fire-affected stands that still have a mature green tree component will be monitored for additional mortality occurring over the next two years. Stands will be surveyed using both informal walk-through exams and formal stand exams to determine fire-related mortality and insect-related mortality.
TYPE: Implementation

Cultural Resources

Monitoring of ongoing resource recovery activities will be carried out, in addition to monitoring site-loss due to natural causes such as erosion and weathering. Monitoring in the form of surveillance and law enforcement to ensure there is no increased site theft would be implemented.
TYPE: Implementation, Effectiveness

Remnants of our pioneer heritage are irreplaceable.

ALTERNATIVE COMPARISON

The estimated environmental effects for each alternative given detailed analysis are summarized below following a discussion of each issue; a discussion of significant differences between alternatives is included. Environmental effects are fully displayed and discussed in Chapter IV.

Recreation Resources

Figure II-2 summarizes the resultant recreation setting and level of recovery or enhancement for recreation sites. Alternative G incorporates the lowest level, Alternative H and J the moderate level, and Alternative I the maximum level. Alternative A will manage recreation activities at current levels. Each recovery package is explained in detail in Appendix H.

Figure II-2 Recreation Resources - Alternative Comparison

ISSUES	ELEMENTS	EFFECTS OF ALTERNATIVES				
		A	G	H	I	J
RECREATION RESOURCES	ROS Inventory (acres)					
	Roaded Natural	10,090	10,090	10,090	10,090	10,090
	Semiprimitive motorized	9,378	9,378	9,378	9,378	9,378
	Semiprimitive nonmotorized	34,618	34,618	34,618	34,618	34,618
	Trail Miles					
	Normal Maint.	0	18.6	13.0	13.0	13.0
	Heavy Maint.	0	33.3	29.6	29.6	29.6
	Reconstruction	0	5.9	13.2	13.2	13.2
	New Construction	0	0	2.0	7.1	2.0
	Trailhead (number)					
	Existing	11	11	11	11	11
	Relocations	0	0	3	3	3
	Consolidations	0	0	4	4	4
	New Locations	0	0	0	2	0
	Disp. Campsites (number)					
	Major Clusters	12	12	11	12	11
	Scattered Sites	62	62	52	62	52
	Water Sources (number)	8	8	8	8	8
	Interpretive Features (number)					
	Sites	0	0	5	11	5
	Trails	0	0	1	3	1

Visual Resource

The Visual Resource issue "Preserving Scenic Values in the NRA" will be addressed by meeting Visual Quality Objectives and the CMP 2-acre maximum opening criteria. However, while meeting these criteria, a range of impacts is created by the alternatives as follows:

A) **Future Visual Condition**--The overall Visual Condition of landscapes within the recovery project area can be analyzed for changes: Alternatives A,H, and I show no changes from their Slightly Altered condition; and Alternatives G and J change from Slightly Altered to Moderately Altered.

B) **Foreground**--Due to the multiple variables that affect tree mortality, the exact prediction of fire-damaged trees that are likely to die is not an exact science; hence prescriptions for salvage in foreground areas may entail a risk of not meeting the VQOs. Alternative J has 300' no-cut buffers on important roads and variable buffers on recreation sites and trails to ensure that VQOs are met. Alternatives G and H have no buffers, but foreground areas will be evaluated by landscape architects and individual tree marking will be used where needed to meet VQOs.

C) **Cumulative Effects**--Even though individual salvage activities (units) should meet VQOs, as a group or together they may disturb too much area at one time (Maximum Disturbance Threshold--MDT): Alternatives A and I have no salvage activities. Alternative G exceeds two MDTs and is under MDTs in all other viewsheds. Alternative H is under MDT in all viewsheds. Alternative J exceeds one MDT, approaches one MDT, and is under MDTs in all other viewsheds.

Figure II-3 Visual Resource - Alternative Comparison

		EFFECTS OF ALTERNATIVES				
ISSUES	ELEMENTS	A	G	H	I	J
VISUAL RESOURCE	FUTURE VISUAL CONDITION changes	no change	slightly altered to moderate altered	no change	no change	slightly altered to moderate altered
	FOREGROUNDS Road	N/A	24 w/no buffers	7 w/no buffers	N/A	24 w/300' buffers
	Recreation Site	N/A	no buffers	no buffers	N/A	with buffers
	Trail (units)	N/A	4	2	N/A	4
	CUMULATIVE EFFECTS					
	Partial Retention (foreground)	N/A	exceeds 2 MDT	under all MDT	N/A	exceeds 1 MDT approach 1 MDT
	Partial Retention (middleground)	N/A	under all MDT	under all MDT	N/A	under all MDT
	Modification (middleground)	N/A	under all MDT	under all MDT	N/A	under all MDT

Water Quality/Fisheries

The alternatives as they relate to changes in water quality and fisheries have no difference other than the amount of ground disturbed by management activities. The buffer zones along Class I, II, and III streams, BMP's, and mitigation measures are the same for all alternatives. Because most of the harvest activities are located away from Class I, II, and III streams and because of the high level of impacts caused by the fire, the differences portrayed by the various recovery alternatives are small. The elements displayed are only those that had a substantial chance of being affected by the action alternatives.

Figure II-4 Water Quality/Fisheries - Alternative Comparison

		EFFECTS OF ALTERNATIVES				
ISSUES	ELEMENTS	A	G	H	I	J
WATER QUALITY/ FISHERIES	Buffer along Class I-II-III streams (ft.)	N/A	200	200	200	200
	Temperature (ave. max temp. in degree F.)					
	10 yr. average	71	71	71	71	71
	1994-98 average	64	63	64	63	64
	Sediment (ave. 5 yr.-ton/sq. mile	32.7	33.0	32.8	32.7	32.9
	Riparian planting (miles)	0	23.0	2.2	23.0	2.2
	Riparian survival plots	0	1.2	1.2	1.2	1.2
	Dissolved oxygen (mg/liter)					
	10 yr. average	7.8	7.8	7.8	7.8	7.8
	1994-98 average	8.3	8.4	8.3	8.4	8.3
	Habitat suitability index (% of carrying capacity)					
	Cotton Creek (rainbow/steelhead trout)					
	* Pre-fire	93	93	93	93	93
	* Yr. 1	0	0	0	0	0
	* Yr. 3	20	20	20	20	20
	* Yr. 5	86	86	86	86	86
	* Yr. 10	94	94	94	94	94
	Cherry Creek (redband trout)					
	* Pre-fire	91	91	91	91	91
	* Yr. 1	10	10	10	10	10
	* Yr. 3	84	84	84	84	84
	* Yr. 5	89	89	89	89	89
	* Yr. 10	91	91	91	91	91
	Cook Creek (redband trout)					
	* Pre-fire	92	92	92	92	92
	* Yr. 1	0	0	0	0	0
	* Yr. 3	0	0	0	0	0
	* Yr. 5	83	83	83	83	83
	* Yr. 10	92	92	92	92	92

Wildlife Habitat

The effects of the alternatives on wildlife habitat are compared in terms of HEI (Habitat Effectiveness Index for elk), amount of old growth, snag levels, and miles of "countable" road. HEI is a relative index combining factors for cover quality, cover spacing, and open road density. The greatest effect on HEI for this project was open road density. "Countable" refers to roads internal to the project being counted at 100 percent and roads that border the project being counted at 50 percent. The effects of open-road traffic upon elk habitat extend outward from both sides of a particular road. Thus, open roads located on the edge of the project area have only one-half the effect of open roads within the project's interior. The higher the index number the better the habitat needs of elk would be met. HEI can be used as an indicator of change for all wildlife species using this habitat type.

Figure II-5 Wildlife Habitat - Alternative Comparison

		EFFECTS OF ALTERNATIVES				
ISSUES	ELEMENTS	A	G	H	I	J
WILDLIFE HABITAT	Elk (HEI) %					
	Winter range	54.8	55.4	55.4	54.8	55.4
	Summer range	59.0	64.1	64.1	59.0	61.9
	Total	54.6	59.9	59.9	58.3	58.7
	Old growth (post-fire acres)					
	DR/TM (designated)	586	715	715	715	715
	DR/NV	787	787	787	787	787
	Forage	149	149	149	149	149
	Open "countable" roads (miles)					
	Winter	17.6	5.3	5.3	14.0	5.3
	Summer	56.7	25.3	25.3	36.3	32.0
	Total	74.3	30.6	30.6	50.3	37.3
	Riparian Planting (miles)	0	23.0	2.2	23.0	2.2
	Snag Habitat % Potential	100	100	100	100	100

Long-Term Site Productivity

Long-term site productivity effects associated with the different alternatives are difficult to compare in table form. Interested reviewers should refer to the discussion in Chapter IV which describes environmental consequences. One reason for the difficulty is the complexity of the variables and the interrelationships involved. However, Figure II-6 portrays two categories for comparison. The first is the amount of compaction and total disturbance (including compaction) not mitigated, displayed by logging system. This is a percent of the acres for that logging system.

The second item is the predicted erosion rate by year for the first 10 years, by alternative. This is displayed as both tons per year for the entire planning area and as a percent change from the existing condition or Alternative A.

Figure II-6 Long-Term Site Productivity - Alternative Comparison

		EFFECTS OF ALTERNATIVES				
ISSUES	ELEMENTS	A	G	H	I	J
LONG-TERM SITE PRODUCTIVITY	Soil Compaction (C)					
	Soil Disturbance (D)					
	Not Mitigated					
	Tractor (C)	0	5%	5%	0	5%
	Skyline (C)	0	3%	3%	0	3%
	(D)	0	8%	8%	0	8%
	Helicopter (C)	0	2%	2%	0	2%
	(D)	0	5%	5%	0	5%
	Erosion rate in tons of eroded soil per year/% change					
	Year 1	7608/0	7660/1.0	7627/<1	7608/<0	7645/<1
	Year 2	3783/0	3805/1.0	3811/1.0	7383/0	3796/<1
	Year 3	2168/0	2195/1.0	2177/<1	2168/0	2188/1.0
	Year 4	1548/0	1563/1.0	1548/<1	1557/0	1557/1.0
	Year 5	1250/0	1255/<1	1252<1	1250/0	1254/<1
	Year 6-10	1104/0	1104/0	1104/0	1104/0	1104/0

Vegetation Management

The riparian deciduous shrub planting will occur predominantly along Cottonwood and Cook Creeks. Natural regeneration predictions are based on analysis of potential seed sources from remaining unburned trees, soils survey data, and the plant association data documented by the Forest Ecologist.

Artificial reforestation will involve hand planting two-year-old nursery grown conifer bare-root seedlings.

Changes in forage production are primarily the result of the fire stimulating young, succulent growth of grasses, forbs and shrubs; reduction of competition from tree shade on these forage species; and the introduction of grass seed by the erosion control rehabilitation project Fall 1988. The harvesting of dead and severely damaged trees will have very minimal effect on forage production, therefore all alternatives are considered to have similar increases in forage production.

The ability to perpetuate healthy stands of diverse tree species, sizes and age classes, and the ability to keep future vegetation management options open, depends heavily upon current steps taken to maintain land operability. Operability is considered to be the relative ease or difficulty with which vegetation management practices can be carried out on a given piece of ground. It is mostly a function of the amount of standing and down fire-killed timber that is removed. If left on-site the dead trees will eventually fall to the ground in a jackstrawed mass, occupy physical space and preclude or complicate management activities of the future.

Figure II-7 Vegetation Management - Alternative Comparison

		EFFECTS OF ALTERNATIVES				
ISSUES	ELEMENTS	A	G	H	I	J
VEGETATION MANAGEMENT	Riparian deciduous shrub planting (stream miles)	0	23.0	2.2	23.0	2.2
	Natural regen. on harvest units (acres)	0	2,476	472	0	1,824
	Artificial reforestation acres:					
	Following salvage	0	877	170	0	608
	Without salvage	0	0	269	303	269
	Total	0	877	439	303	877
	Changes in forage production	increased	increased	increased	increased	increased
	Acres of DR/TM w/improved future operability and Vegetative Manag. options (acres)	0	3,084	911	0	2,701

Transportation System

Three road management options were developed to be incorporated into the different alternatives.

1. **High** -- High amount of road closures for the benefit of elk habitat.
2. **Low** -- Low amount of road closure to help increase dispersed recreation access.
3. **Medium** -- Medium amount of road closure as a compromise between the high and low options.

Alternatives G and H have the High road management option attached, Alternative I has the Low road management option attached, and Alternative J has the Medium road management option attached.

Figure II-8 compares miles of permanent road construction and temporary road construction, total miles of roads open to the public by land use allocation, acres of logging system, and miles of road removed from the transportation system.

Figure II-8 Transportation System - Alternative Comparison

		EFFECTS OF ALTERNATIVES				
ISSUES	ELEMENTS	A	G	H	I	J
TRANSPORTATION SYSTEM	Road construc. * (miles)					
	Permanent	0	3.9	2.7	0	3.9
	Temporary	0	1.3	0.4	0	1.3
	Open road (miles) (public)					
	DR/TM	74.4	30.5	30.5	42.3	36.8
	DR/NV	20.3	8.6	8.6	18.0	8.6
	Forage	3.7	0	0	0	0
	Miles of road removed from road system	0	12.4	12.4	11.3	12.2
	Acres by logging method					
	Tractor	0	1,674	523	0	1,392
	Cable	0	314	79	0	311
	Helicopter	0	1,432	376	0	1,059

* Road Construction all in DR/TM

Rapid Timber Recovery

For more information on existing acres and volume of fire-killed and severely damaged trees on all land ownerships, reviewers are referred to Appendix J.

The guidelines and management direction of the CMP preclude harvesting all fire-affected timber. Common to all alternatives, an estimated 140 MMBF of net merchantable volume can not be harvested within the bounds of the CMP direction.

Figure II-9 Rapid Timber Recovery - Alternative Comparison

		EFFECTS OF ALTERNATIVES				
ISSUES	ELEMENTS	A	G	H	I	J
RAPID TIMBER RECOVERY						
	Land area salvage logged (acres)					
	DR/TM	0	3,084	911	0	2,701
	DR/NV	0	0	0	0	0
	Forage	0	269	0	0	0
	Total	0	3,353	911	0	2,701
	Proposed harvest volume (MMBF)					
	DR/TM	0	27.5	7.5	0	22.6
	DR/NV	0	0	0	0	0
	Forage	0	3.2	0	0	0
	Total	0	30.7	7.5	0	22.6
	Skyline system (MMBF)	0	3.1	0.7	0	3.1
	Helicopter system (MMBF)	0	15.8	3.5	0	10.8
	Tractor system (MMBF)	0	11.8	3.3	0	8.7
	Net volume NOT harvestable in NRA due to CMP mgmt. direction (MMBF)					
	DR/TM	25.0	25.0	25.0	25.0	25.0
	DR/NV	70.8	70.8	70.8	70.8	70.8
	Forage	44.2	44.2	44.2	44.2	44.2
	Subtotal	140.0	140.0	140.0	140.0	140.0
	Net volume NOT harvestable in NRA due to theme of alternative (MMBF)					
	DR/TM	27.5	0	20.0	27.5	4.9
	DR/NV	0	0	0	0	0
	Forage	3.2	0	3.2	3.2	3.2
	Subtotal	30.7	0	23.2	30.7	8.1
	Total net volume unharvested in NRA (MMBF)	170.7	140.0	163.2	170.7	148.1

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Economics

Three parameters were measured which are used to show the relative economic differences between alternatives. Present Net Value (PNV) includes only the costs and benefits of those factors which can have a reasonable economic value placed on them. The general areas included are: timber salvage; recreation, including big game hunting; resource recovery projects; and commercial mushroom gathering. The number of direct jobs are estimated using an economic input-output model. The numbers of jobs, both full and part time, which will be directly associated with this project are displayed.

"Payments to county" is an estimate of what portion of the National Forest timber receipts (as a result of the timber salvage) will be paid to Wallowa county instead of taxes.

These figures should be regarded as a measure of the relative differences between alternatives and not as an absolute measure of their face value.

Figure II-10 Economics - Alternative Comparison

		EFFECTS OF ALTERNATIVES				
ISSUES	ELEMENTS	A	G	H	I	J
ECONOMICS (Values in thousands of dollars)	PNV	$18,503	11,047	13,677	13,626	11,790
	Direct jobs	87	203	107	80	175
	Payments to county	0	73	18	0	54

THE PREFERRED ALTERNATIVE

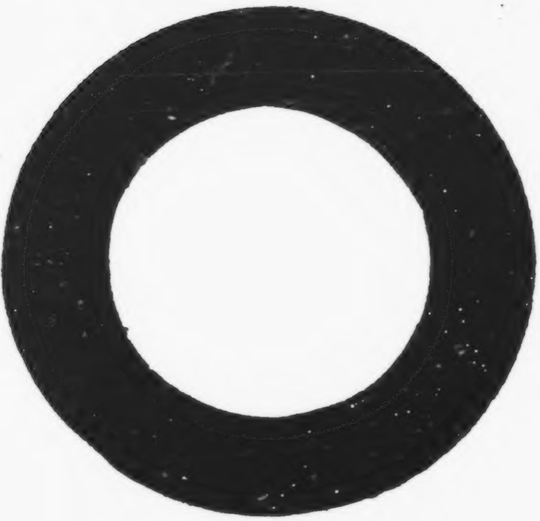
Alternative G has been chosen by the Forest Supervisor as the Preferred Alternative. It was selected after careful study. Consideration was given to the predicted levels of resource outputs, environmental effects, and implementation costs, as well as the Hells Canyon NRA Comprehensive Management Plan objectives and guidelines which in turn reflect the will of Congress in the Hells Canyon NRA establishment act.

Nothing in this DEIS obligates the Forest Service to carry out provisions of the alternatives if funding for the projects is not appropriated by Congress.

Additional field verification of land suitability, plantability, and wildlife cover may result in minor changes between the Draft and Final EIS.

CHAPTER III

AFFECTED ENVIRONMENT



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CHAPTER III

THE AFFECTED ENVIRONMENT

INTRODUCTION

This chapter describes the environment in and near the Tepee Butte Fire Recovery Area, including pre- and post-fire conditions. It focuses on physical, biological, economic, and social conditions that may be affected by implementation of alternatives. Resource conditions directly related to development of the issues presented in Chapter I are emphasized. This chapter provides a basis for disclosure of environmental consequences in Chapter IV.

Components of the "affected environments" are discussed in this chapter in a sequence corresponding to the order in which issues are presented in Chapter I. Discussions of these environmental components follow a description of the project area--its location, climate, topography, and geology.

Project Area

The Tepee Butte Fire burned approximately 60,000 acres in August, 1988. The burned area lies mostly within the boundaries of the Hells Canyon National Recreation Area in northeastern Oregon just south of the Oregon-Washington border. The Hells Canyon NRA encompasses 652,488 acres. The area is administered by the Wallowa-Whitman National Forest and is approximately 30 miles northeast of Enterprise, Oregon, in Wallowa County. A portion of the burn is on land administered by the U.S. Department of Interior, Bureau of Land Management, and is included in this analysis. Several thousand acres of privately-owned land were also burned. These private lands were considered in the cumulative effects analyses but were not considered for inclusion in any "recovery" projects.

Annual precipitation ranges from 10 to 25 inches. Most occurs as snow during the winter season (October through March). The summer precipitation falls in minor amounts, however, some thunderstorms sometimes accompanied by heavy rain occur. Summer temperatures at lower elevations occasionally exceed 100 degrees F (along the Snake River) while at the higher elevations temperatures usually are cooler.

The project area is described by two different topographic features--flat ridges and steep canyons. Cold Spring Ridge is an example of an area dominated by broad, flat ridges. The steep, rugged canyon terrain is similar to other areas in the Wallowa-Snake Province in northeastern Oregon. This area is characterized by deeply incised drainages in rocky canyons, steep sideslopes, and rock cliffs. Elevations range from 900 feet above sea level at the Snake River to 5,400 feet on Cold Spring Ridge.

The project area lies within two geomorphic divisions of Oregon, Joseph Upland and Snake River Canyon. The Joseph Upland is underlain by a thick succession of flat-lying basalts with few sedimentary interbeds, and the area is deeply incised by numerous streams. The Snake River has carved through the Joseph Upland basalts and into basement rocks of the Blue Mountains, exposing older formations along the course of the canyon bottom (Oregon 1959).

The Snake River bounds the east side of the burned area. Cottonwood, Cook, and Cherry Creeks are the other principal streams in the area.

A number of rock types are found within the project area. Some of these rock types have site-specific implications to consider in project design. For instance, some rock types indicate areas of potential instability, presence of water lenses and clay seams, or areas of past failures. Detailed descriptions of specific rock types are presented in Appendix L.

The steep, rugged terrain is similar to other areas in the Wallowa-Snake Province in northeastern Oregon.

RESOURCES RELATED DIRECTLY TO THE MAJOR ISSUES

RECREATION RESOURCES

The Hells Canyon NRA was established by Congress to preserve the free flowing character of the Snake River in Hells Canyon; to protect its archaeological, historical, and ecological values; and to enhance recreational opportunities and public enjoyment of the area. From the steep alpine peaks of the Idaho portion to the benches and grasslands of the Oregon portion, beauty, mystery, and challenge await recreationists who visit the NRA. Opportunities abound to explore its 652,488 acres which contain the 214,000-acre Hells Canyon Wilderness, 159 miles of the National Wild and Scenic River System, 18 developed campgrounds, and thousands of acres of dispersed camping lands.

Most of the NRA is remote, undeveloped, and inaccessible. Clear, free-flowing streams dissect this expansive and isolated land. Good roads and campgrounds within the NRA are limited, but heavily used during the summer months. An extensive trail system follows old stock trails used by ranchers to move livestock to remote salting areas and watering holes. Many of these trails are heavily used from early spring to late fall.

Deer, elk, bear, and the even more elusive bighorn sheep, mountain goat, and cougar can be seen by visitors who hike, horsepack, or drive through the area. Many bird species are easily observed in their natural surroundings, and a wide variety of wildflowers bloom from early spring to fall.

Visitors can also find evidence of past cultures and historic uses scattered throughout the area. Petroglyphs and pictographs, early homesteads and ranches, abandoned farm machinery and mining equipment, and the remains of early logging activity are visible in many parts of the area.

The area offers a long season of use and a diverse range of recreational opportunities. The same mild winter climate, abundance of wild animals, and timeless natural beauty that beckoned early explorers and settlers to Hells Canyon now attracts recreationists from all parts of the United States. Recreational use of the area began during the 1940s when outfitters and guides introduced adventurers to the Snake River canyon in wooden boats and rubber rafts. "River running" increased rapidly, encouraged by the availability of durable and inexpensive rubber rafts which were surplussed by the armed forces after World War II. Increased river use gave rise to increased interest in sport fishing and big game hunting. Both of these activities have become well established uses of the NRA. During the 1950s horsepacking began gaining in popularity, followed by a boom of backpacking in the late 1960s and early 1970s. This popular new use brought thousands of visitors to many remote parts of the area. Since the NRA was established in 1975, the development of roads, trails, camping areas and interpretive sites has encouraged continued use of this unique National resource.

The Oregon side of the NRA contains vast expanses of open country dominated by bunchgrass and shrubs at lower elevations. Cottonwood, aspen, and willow grow adjacent to the lower streamchannels, while stringers of fir and pine fill the north aspects of the higher stream drainages. The upland ridges support dense stands of Douglas-fir and grand fir, many of which are managed as Old Growth forest.

The Tepee Butte project area is approximately 9 percent of the NRA. It provides an optimum environment for high quality recreation, and offers a spectrum of recreational opportunities that attracts visitors throughout the year. Buckhorn Spring Campground, Buckhorn Lookout, and Cold Spring Ridge are focal points for spring, summer, and fall recreation. Buckhorn Spring Campground provides an easily accessible landfall from which the project area can be explored, and the lookout offers a panoramic view of the Snake River, the Rim of Hells Canyon, the Seven Devils peaks in Idaho, and the breaks of the Imnaha River country.

Because of the project area's remote location and limited access, overall visitor density is generally low. However, the road corridors support substantially higher than average use, especially during big game hunting seasons. Wellamotkin Drive (46), Cold Spring Road (4680), Cemetery Ridge Road (4600780), Deadhorse Ridge Road (4600760), and Wildhorse Ridge Road (4600596) provide the main access to the project area.

Recreation Opportunity Spectrum

Recreation resource management is based on a classification system known as the Recreation Opportunity Spectrum (ROS), which provides a framework for stratifying and defining classes of recreational environments, activities, and experiences. ROS is an inventory of recreational opportunities, not a management allocation. It contains six possible recreation opportunity classes: Urban, Rural, Roaded Natural, Semiprimitive Motorized, Semiprimitive Nonmotorized, and Primitive. The project area contains three of these six classes: Roaded Natural, Semiprimitive Motorized, and Semiprimitive Nonmotorized. Figure III-1 displays the acreage of each class. Class boundaries are delineated on Figure III-2. Definitions for the three classes are given in the Glossary.

Figure III-1 Recreation Opportunity Spectrum Inventory

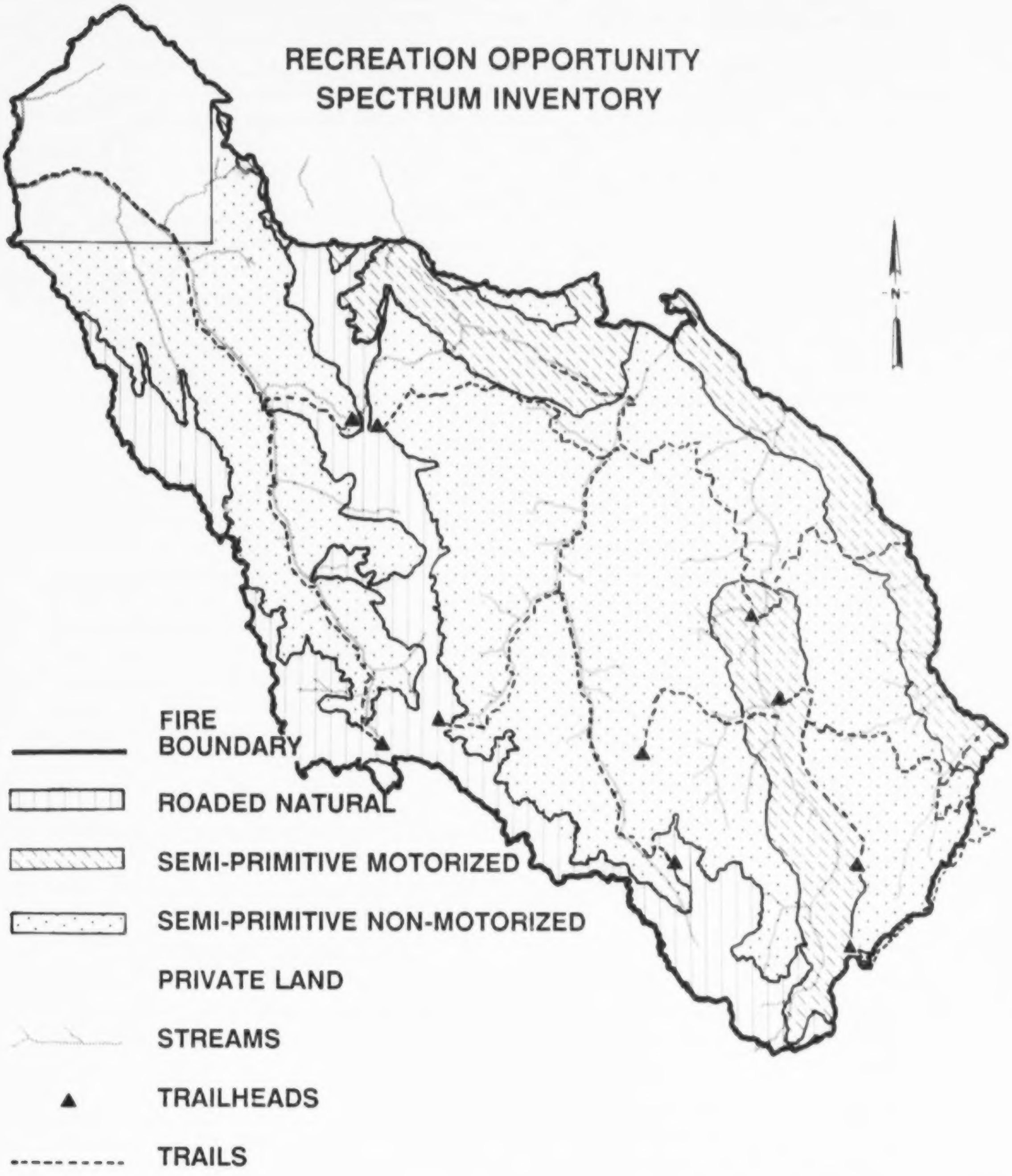
Rec Opp Classes	Acreage	Percent of Area
Roaded Natural	10,090	18.53
SPM	9,738	17.89
SPNM	34,618	63.58
	54,446	100.00

Recreational Use

Pre-Fire Conditions--Visitors pursue a variety of recreational activities commensurate with settings and experiences sought. The primary activity is big game hunting for deer, elk, bear, and cougar. Secondary activities include bird hunting, camping, sightseeing, and firewood cutting. Other dispersed uses include backpacking, horsepacking, day hiking, bird watching, mushroom gathering, snowmobiling, mountain biking, and all-terrain vehicle travel.

ROS MAP

III-2


RECREATION OPPORTUNITY SPECTRUM INVENTORY
N
FIRE BOUNDARY
ROADED NATURAL
SEMI-PRIMITIVE MOTORIZED
SEMI-PRIMITIVE NON-MOTORIZED
PRIVATE LAND
STREAMS
TRAILHEADS
TRAILS

The measurement of recreation use is based on the Recreation Visitor Day (RVD). A RVD is defined as the equivalent of one person recreating for a total of 12 hours. This time may consist of 1 person recreating for 12 hours, 12 persons for 1 hour, or any equivalent combination. When people participate in more than one activity in a given instance (for example, camping or hiking while hunting), the RVD represents the primary experience sought by the visitor. The 52,800 annual RVDs associated with the Tepee Butte project area are itemized in Figure III-3.

Figure III-3 Annual Recreation Visitor Days by Activity

Recreation Activity	Annual Recreation Visitor Days
Big Game Hunting (Deer, Elk, Bear, Cougar)	45,500
Sightseeing	3,500
Firewood Cutting	1,600
Camping	600
Mushroom Gathering	300
Bird Hunting	300
Snowmobiling	200
Horsepacking	200
Backpacking	200
All Terrain Vehicle Travel	100
Day Hiking	100
Mountain Biking	100
Bird Watching	100

Deer, elk, bear, and cougar are hunted during open seasons which range from mid-August through late December. This hunting accounts for 86 percent of the area's total use. It begins with a 30-day archery season for buck deer and bull elk, that attracts approximately 500 hunters. One week after archery season ends, a 12-day rifle season for buck deer begins. This is the general deer hunting season in eastern Oregon, and it attracts approximately 1,000 hunters to the project area. One month following the end of deer season, a 9-day rifle season for bull elk begins. This is a limited entry hunt; permits are issued to only 1,500 hunters. One week following bull elk season, a 7-day rifle season for cow elk begins. This is also a limited entry hunt; only 400 permits are issued.

Bear are hunted during two open seasons. A recently instituted, limited entry hunt occurs in April and May. Currently, 100 permits are issued, and the hunt is becoming more popular each year. The majority of bear hunting occurs in the fall in association with deer and elk hunting. The open season begins in mid-August just before the archery hunt and continues through the cow elk hunt in late November. Most bear are taken by deer and elk hunters, incidental to their primary hunt.

Cougar hunting, the final big game season of the year, is permitted throughout December. This hunt is also limited. Forty permits are issued, and dogs are used to track and tree the animals.

Big game hunting in the project area attracts hunters from Oregon, Washington, Idaho, and other western states. Approximately 75 percent of the hunters reside in western Oregon. Only 15 percent are eastern Oregon residents, and the remaining 10 percent are from other states. Most hunters arrive with motor homes, travel trailers, campers, and tents. Elaborate camps are set up along major access Roads 46, 4680, 4600596, and 4600760. The camps along these roads are numerous, averaging 8 to 10 per mile. The Buckhorn area also receives heavy use during each hunting season. Some of the more popular big game hunting camps are displayed in Figure III-4.

From these camps, the project area is hunted on foot, from horseback, and from vehicles. Approximately 50 percent of the hunting is from vehicles and about 20 percent from horseback. Hunting from vehicles is heaviest during archery and deer seasons because more roads are open. During the elk seasons, the Chesnimnus Cooperative Road Closure prohibits travel on all but the main access roads. In addition to the road corridor camping, approximately 10 percent of the hunters horsepack into remote camps in the Cherry, Cook, and Cottonwood drainages.

Hunting activity is heaviest during the first week of each season. The last week of archery season also attracts heavy use. The same campsites are used for each hunting season. Although the majority of these campsites are located along the main access roads, the actual hunting is well dispersed throughout the project area. The trail system receives much heavier use during hunting season than during other times of the year. All ridges and drainages are heavily hunted from archery through bull elk season. During cow elk and cougar seasons, most of the hunting focuses on lower elevation areas because the late fall weather discourages hunters from camping on the higher ridges. The Buckhorn area and Cherry Creek are preferred areas for late November and December hunts.

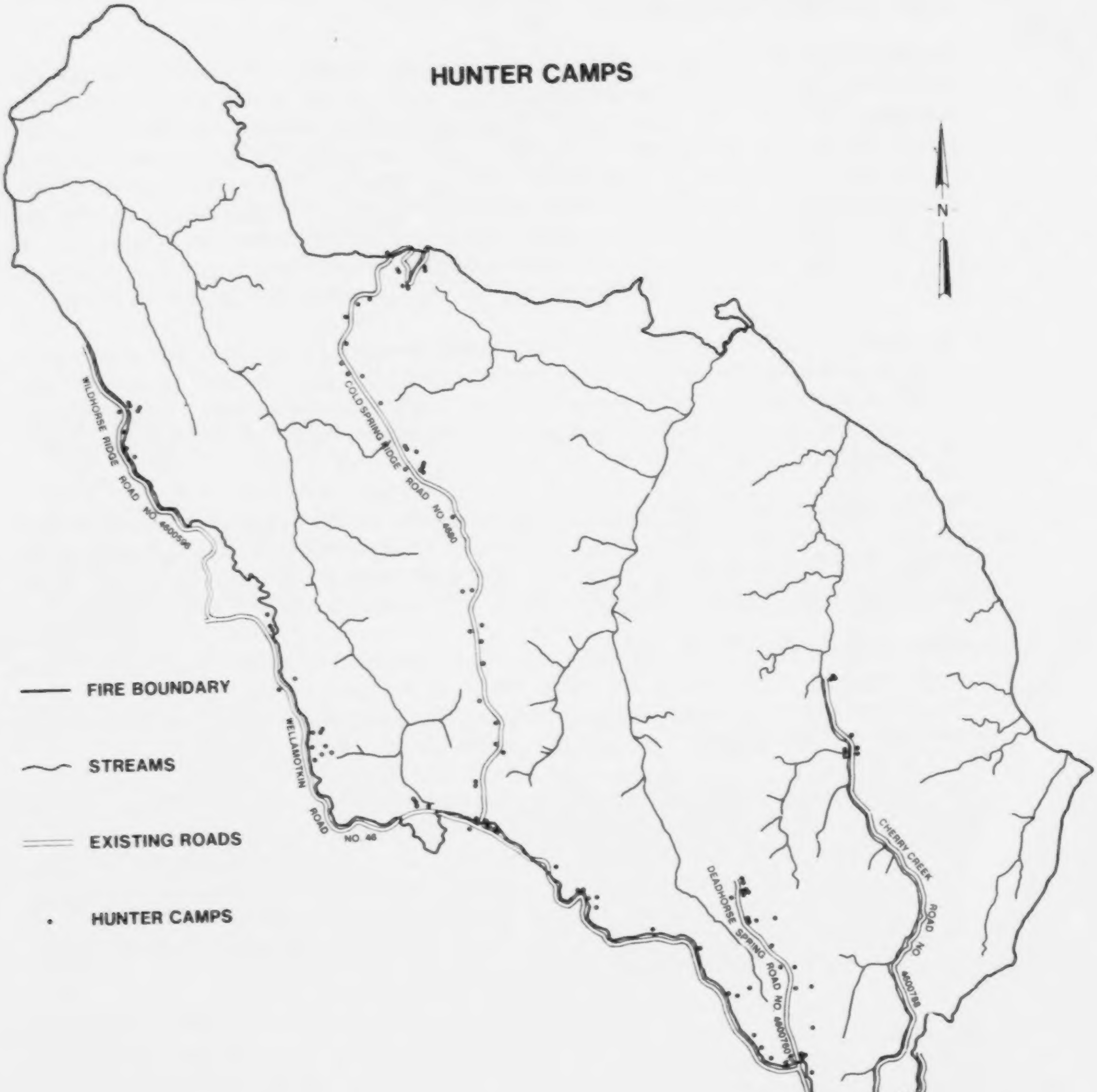
Although big game hunting is the primary recreation activity associated with the project area, several other activities are pursued throughout the year. Winter use is light; it is limited to snowmobiling. Snowmobilers use the roaded areas and account for less than 1 percent of the area's use. Because roads are usually not plowed during the winter, there is no access for cross-country skiing.

As the roads and trails begin to open in May and June, a small amount of use occurs with mushroom gathering. Mushrooms are available for approximately a month, and the use is less than 1 percent of the area's total. Because most mushrooms are found in the timbered areas, this use is generally limited to the area within the DR/TM allocation.

By mid-June all roads and trails are open, and vacationers from Oregon and other states begin camping, sightseeing, and day hiking in the area. Continuing through mid-September, these activities center around the Buckhorn and Cold Spring ridges and account for approximately 8 percent of the area's total use.

As the summer progresses, backpacking and horsepacking into the Cook and Cottonwood drainages begin. These are popular drainages because of the opportunities to see wildlife and to fish for redband trout. Both backpacking and horsepacking are minimal uses of the area, accounting for less than 2 percent of the total use. Although some fishing occurs concurrently with these activities, it is a negligible measure of the area's total recreation use. Streams in the project area are small and provide no water-oriented recreation such as rafting, kayaking, or boating.

FIGURE III-4
HUNTER CAMPS MAP


HUNTER CAMPS
N
WILDHORSE RIDGE ROAD NO 4600596
COLD SPRING RIDGE ROAD NO 4680
WELLAMOTKIN ROAD NO 46
DEADHORSE SPRING ROAD NO 4600760
CHERRY CREEK ROAD NO 4600788
CEMETERY RIDGE ROAD NO 4600760
FIRE BOUNDARY
STREAMS
EXISTING ROADS
HUNTER CAMPS

Horsepacking provides access to remote areas for fishing and observing wildlife.

Firewood cutting takes place from June until November. Use is limited to the open roads within the DR/TM allocation. Only local residents cut firewood in the area, and this activity accounts for approximately 3 percent of the use.

Bird hunting for grouse, chukar, and turkeys occurs intermittently during open seasons in the spring and fall. Approximately half of the hunters are local residents, and half are from western Oregon and eastern Washington. Approximately half of the use is day hunting, and half of the hunters camp in the project area along the main access roads. Bird hunting accounts for approximately 1 percent of the area's total use.

Post-Fire Conditions--Recreation use has been moderately influenced by the fire. No major shifts in hunter density or dispersal were noted in adjacent areas during Fall, 1988, and winter use appears normal. Opportunities for trail use are limited because of disrupted trail segments. Activities such as sightseeing, day hiking, and mushroom gathering are expected to increase in the short term. Increases in sightseeing and day hiking are expected because people are curious about how the fire has changed the area. An increase in mushroom gathering is expected because the production of morels, a delectable food species, increases following fire.

Floating and power-boating are popular activities on the Snake River along the eastern edge of the project area. The fire blackened and killed some vegetation that is visible from the river -- grassland in the foreground and timber stringers in the middleground and background. Ground vegetation regrowth in 1989 will mask the burned appearance of grassland areas, and the overall effect of the fire on the enjoyment of river activities will be minimal.

Recreational Access

Most of the project area is unroaded. A trail system provides adequate access to the area's interior. The system receives moderate use and requires little annual maintenance. Most routes were initially developed to support ranching operations, and some have been subsequently improved for recreational use. In 1988, Pika Press published a trail guide highlighting the Cottonwood, Cook, and Five Points trails. The trail guide, *Hiking the High Wallowas and Hells Canyon*, was prepared by members of the Wallowa Resource Council and edited by Frank Conley.

Low-standard, single lane roads with gravel or dirt surfacing provide access to developed campgrounds, dispersed campsites, trailheads, water sources, and viewpoints.

Pre-Fire Conditions--Trails located on steep grades showed signs of erosion from commercial livestock use. Trails which follow ridgelines, moderately sloped terraces, and benchlands were stable. Figure III-5 displays each trail by name, number, and length. The area's trail system is mapped on Figure III-2.

Figure III-5 Trail System

Trail Name	Number	Mileage	Trailhead Location
Cemetery Ridge	1731	2.8	SW 1/4, SEC.27, T4N, R48E
Chalk Creek	1702	6.0	NE 1/4, SEC.8, T4N, R48E
Cherry Creek	1705	6.0	SE 1/4, SEC.23, T5N, R47E
Cook Creek	1697	8.3	SE 1/4, SEC.30, T4N, R48E
Cottonwood Creek	1696	10.0	NW 1/4, SEC.21, T4N, R47E
Deadhorn Creek	1708	1.5	NE 1/4, SEC.29, T5N, R37E
Dry Creek	1704	5.0	SW 1/4, SEC.28, T5N, R47E
Eureka Creek	1732	5.6	NW 1/4, SEC.53, T3N, R48E
Fire Points Creek	1697A	4.0	SW 1/4, SEC.15, T4N, R47E
Imnaha Breaks	1713.1	5.6	SW 1/4, SEC.16, T4N, R48E
Old Mar Creek	1719	3.0	NW 1/4, SEC.19, T4N, R48E

Post-Fire Conditions--All trails were posted at trailheads as dangerous and unmaintained. Fire damage to the trail system varies from minimal to severe. Although most of the trails remain intact, many segments contain obstacles and hazards. Burned trees have fallen across or rolled onto trails, hindering travel through timbered uplands and narrow canyons. In severely burned areas, lateral tree roots burned beneath the trail tread and created subtread cavities which pose hidden hazards to travelers and livestock. Trees uprooted immediately adjacent to trails left large holes in the tread, disrupting or destroying many trail segments.

The road system sustained minimal damage from the fire, but bulldozer operations displaced soil along some road segments.

Recreation Sites

Pre-Fire Conditions--The project area contains several established recreation sites. These sites include dispersed campsites, hunting camps, water sources, and trailheads. Management prescriptions had been developed for each site before the fire. These prescriptions addressed site access, present condition, required maintenance, recreational value, vegetative framing, and enhancement potential.

Post-Fire Conditions--Because the fire damaged or destroyed many of the recreation sites and their adjacent vegetation, most prescriptions will need revision. The Tepee Butte

Fire Recovery Project provides varying opportunities to enhance the recreational values associated with many of these sites, especially the trailheads and campsites adjacent to primary recreation roads. Descriptive and photographic data were collected at each recreation site for revision of the prescriptions. (See Appendix H for the recreation site prescriptions.)

Dispersed campsites are used by vacationing campers during the summer and are heavily used by deer and elk hunters in the fall. Many of these campsites are displayed in Figure III-4. Because dispersed campsites are subject to varying levels of use, some sites are more evident than others. An inventory of these was attempted after the fire. However, fall weather precluded a complete inventory. Although many of the larger sites were mapped, not all have been located. A follow-up inventory is planned to locate and map the remaining campsites as soon as the area is free of snow.

Dispersed campsites are used by vacationing campers during the summer and are heavily used by deer and elk hunters in the fall.

Interpretive Sites

As a naturally occurring event, fire influences the ecology of the area and adds variety and diversity to the landscape. As a result of these ecological and visual changes, there are opportunities to interpret for visitors the role of fire in shaping the affected ecosystems. These opportunities occur at many points along travelways and at several of the recreation sites mentioned above.

Hazard Trees

Many trees damaged by the fire constitute hazards to recreationists. Hazard trees are located adjacent to all travelways and near many recreation sites. The extent of damage and the hazard potential of each tree is evaluated before individual trees are removed.

Scenic Corridor

The Snake River, forming the eastern boundary of the project area, was designated as a Scenic River by Public Law 94-199. The river corridor's scenic quality sustained minimal impact from the fire. A low-intensity fire burned intermittently along the scenic corridor's toe slopes and alluvial fans.

Wilderness Potential

The Environmental Impact Statement for Hells Canyon NRA considered the Mountain Sheep Wilderness Study Area and the Cook Ridge and Wildhorse Roadless Areas for Wilderness designation. However, each area was allocated to non-wilderness resource uses. The Mountain Sheep and Cook Ridge areas were allocated to Dispersed Recreation/Native Vegetation, which emphasizes Semiprimitive Nonmotorized recreation management. Portions of the Wildhorse area were allocated to Dispersed Recreation/Timber Management and to Forage.

VISUAL RESOURCE

Introduction

Protection and enhancement of scenic values is a primary management goal and a key consideration in all resource management decisions in the Hells Canyon NRA. Visual resource management goals are based on the inherent scenic quality of the landscape combined with public interest levels as expressed by use of travel routes and facilities. This combination suggests what alterations of the visual resource are acceptable.

Landscapes within the Tepee Butte Project area are dominated by several broad ridges and major north-south stream drainages. The ridgetops provide panoramic views into rugged, steep canyons of terraced lava flows with unusual rock formations. Interesting form, line, color, and texture contrasts are created by the natural mosaics of plant communities and land forms. Continuous mixed-species coniferous forests dominate the broad ridgetops and heads of drainages. In the high canyonlands, stringers of evergreens dominate the north and east slopes, while shrub and grass communities with scattered fir and pine trees occur on the drier south and west slopes. Shrub and grasslands dominate the lower elevations, with thick brush crowding stream courses.

Pre-fire Condition--Both historic and recent visual evidence of human activity exists throughout the project area. Historic activities included mining, forest management, and early settlement. More recent visual alteration comes from road construction, hunter camps, livestock grazing, timber harvest, and fire suppression. The broken topography tends to buffer and screen activity and concentrate use along travelways. Overall, the visual impact of human activity remains subordinate to the natural landscape and the existing visual condition of the area remains essentially natural (See Viewsheds discussion, Page ??).

Post-fire Condition--Lightning-caused fires are a natural process and are not considered by visual resource management to be a visually degrading disturbance. The effects of the Tepee Butte Fire on the landscape are visually prominent, yet natural in appearance, because of the interaction of fire behavior, topographic features, and vegetative patterns.

In general, the fire produced positive visual effects by introducing additional variety and diversity to vegetation. New patterns of colors and textures were introduced by the mosaic of burned and unburned areas; line patterns were created from dense thickets of timber which are now stands of tall, darkened snags. In some cases, particularly in foreground areas, tree-crown scorch, burned trunks and a blackened forest floor create a strong, short-term harsh effect which is expected to change with the spring green-up.

An indirect influence on visual resources is imposed by fire suppression activities. Light to severe disturbance of soils and vegetation has occurred where machinery was staged and firelines constructed. Most of the severely impacted sites have been grass-seeded for erosion control, but additional rehabilitation may be necessary to recover pre-fire scenic values.

The ridgetops provide panoramic views into rugged, steep canyons of terraced lava flows with unusual rock formations.

Visual Management System

Landscape "character types" are used as a frame of reference to classify the physical features or the degree of scenic value and variety of a given area. The project area lies entirely within the Blue Mountains Character Type (Fenneman 1931), a large province in eastern Oregon. Three classes within this landscape character type are: Variety Class A - Distinctive; Variety Class B - Common; and Variety Class C - Minimal. Approximately 80 percent of the area is Variety Class A which includes landscapes dominated by steep canyons, frequent rock outcrops, and varied vegetative patterns. Variety Class B occupies 20 percent of the project area, and consists of moderately scenic, broad, flat ridgetops and gentler rolling terrain with less varied vegetative patterns. There are no Variety Class C landscapes (dull or monotonous scenery) within the project area.

Sensitivity Level is a second element which refers to the number and type of people who view the forest landscape. The Sensitivity Level of a landscape increases as the numbers of recreation-oriented visitors to an area increase. The most sensitive (Level I) travel route in the Tepee Butte area is the Snake River. The moderately sensitive (Level II) routes are the Wellamotkin Drive (46) and the Cold Spring Road (4680).

A third element of the visual management system is the concept of distance and visual impact. Increasing the distance from the viewer to an activity reduces the noticeable details and impact of the activity. A viewed activity is considered to be in one of three distance zones: Foreground (fg) extends from the viewer out to 1/2 mile; Middleground (mg) is from 1/2 to 5 miles; and Background (bg) is 5 miles beyond the viewer.

Visual Quality Objectives--In order to develop management objectives for the visual resource of Hells Canyon NRA, a visual resource inventory was completed in 1978. Using landscape variety classes, viewer sensitivity levels, and viewer distance zones, Visual Quality Objectives (VQOs) were established to determine the amount of alteration any portion of Hells Canyon NRA could sustain without jeopardizing its visual quality. Arraying these values, five categories of VQOs are identified:

> **Preservation** allows only ecological change.
>
> **Retention** provides for management activities which are not visually evident to the casual forest visitor.
>
> **Partial Retention** permits management activities that are evident, but remain visually subordinate to the characteristic landscape.
>
> **Modification** permits management activities which may visually dominate the characteristic landscape, but should appear natural when viewed at middleground or background distances.
>
> **Maximum Modification** permits management activities which may visually dominate the characteristic landscape when viewed as foreground or middleground, but should appear natural when viewed as background.

The inventoried VQOs were adopted by the Hells Canyon NRA in its Comprehensive Management Plan (CMP). The adopted VQOs describe the maximum amount of alteration that will be allowed to occur within any one area. Figure III-6 displays adopted VQO acreages and percent of the project area.

Figure III-6 Visual Quality Objectives for the Project Area

VISUAL OBJECTIVE	ADOPTED VQO's	
	ACRES	PERCENT
Retention	5,263	10
Partial Retention	43,595	80
Modification	5,461	10
Total Acres	54319	100

Visual Condition Inventory--This inventory describes the visual appearance of a landscape in terms of the degree of alteration of the natural appearing landscape:

- Natural Appearing---no more than 5 percent of the area actually seen appears to be visually altered.
- Slightly Altered---no more than 10 percent of the area actually seen appears to be visually altered.
- Moderately Altered---no more than 20 percent of the area actually seen appears to be visually altered.
- Heavily Altered---no more than 20 percent of the area actually seen appears to be visually altered.

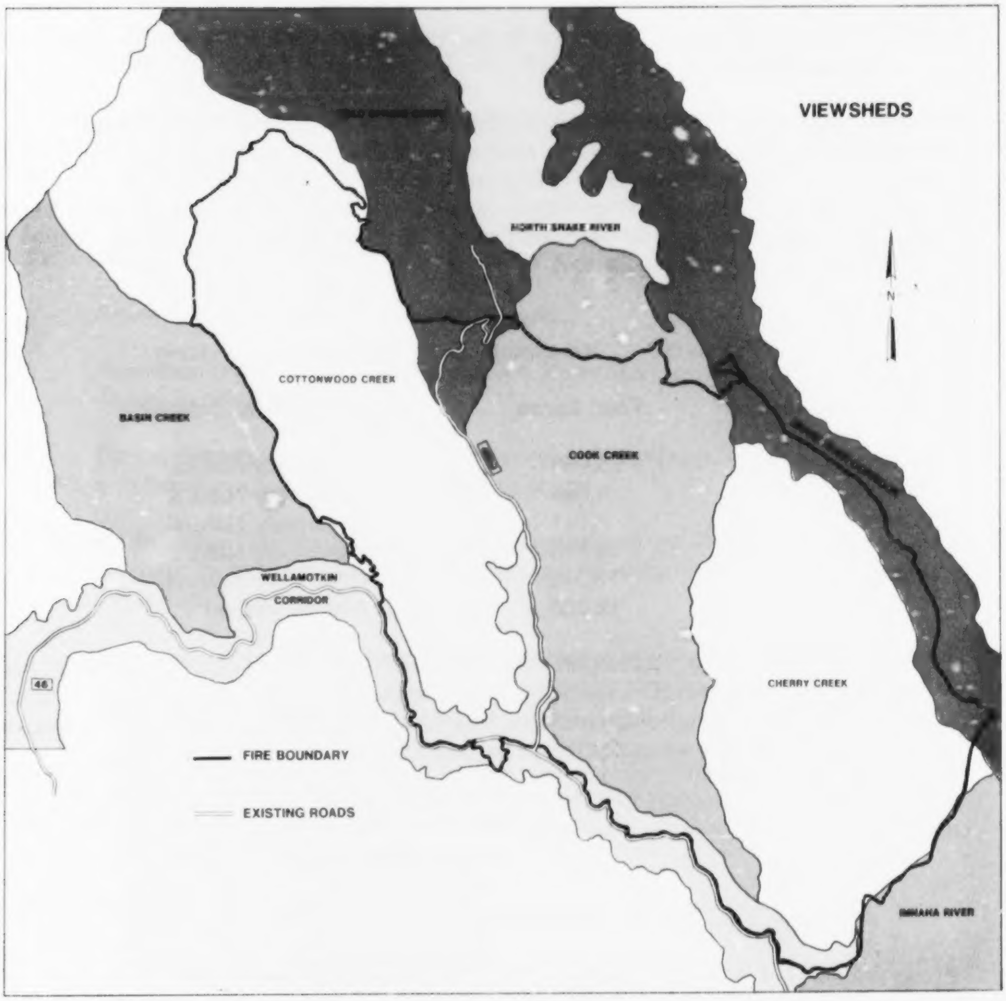
Viewsheds, similar to watersheds, are subunits of the landscape where a visitor's view is contained by topography. Viewshed delineation is useful for assessing any changes that may occur to the landscape as a result of proposed management activities. Viewsheds are classified into existing visual condition classes based on the amount of visual impact evident in the landscape as described above. The project area is contained within six viewsheds as shown in Figure III-7.

Figure III-7 Viewsheds and Existing Visual Condition

Viewshed Name	Total Acres	Existing Visual Condition
Cottonwood Creek	25,088	Essentially Natural
Cold Spring Creek	4,046	Essentially Natural
Scenic Snake River	7,111	Essentially Natural
Cook Creek	19,885	Essentially Natural
Cherry Creek	17,619	Essentially Natural
Wellamotkin	12,603	Slightly Altered

The Cottonwood Creek, Cold Spring Creek, Scenic Snake River, Cook Creek, and Cherry Creek viewsheds retain an essentially natural appearance, due to a minimal amount of visual impact caused by human activities. The Wellamotkin viewshed is slightly altered due to minor amounts of roading and timber harvest activity. Viewsheds are displayed in Figure III-8.

VIEWSHEDS MAP


VIEWSHEDS
N
NORTH SNAKE RIVER
COTTONWOOD CREEK
BASIN CREEK
COOK CREEK
WELLAMOTKIN
CORRIDOR
46
CHERRY CREEK
IMNAHA RIVER
FIRE BOUNDARY
EXISTING ROADS

Cumulative Effects (Maximum Disturbance)

The visual concept of "disturbance-at-one-time" addresses the cumulative effects of management activities (usually timber harvesting) occurring in each viewshed in a given time period. The clear cut and partial cut acres of harvest activity are then related to the known threshold for each Visual Quality Objective. Each harvest unit may individually meet the VQO assigned to the area where the harvest occurred. As a group, however, they may disturb or change too much of the natural landscape during one period of time and exceed the spatial (distribution) limitations of the viewshed.

Twenty years of plantation growth is usually required for a regenerated stand to recover the appearance of a continuous textured landscape and a harvest unit is not considered visually apparent after twenty years of regrowth. The maximum disturbance at-one-time for each VQO within each viewshed is called the "Maximum Disturbances Threshold." This MDT is 14% for the Partial Retention (foreground) VQO; 20% for Partial Retention (middleground); and 30% for Modification (middleground) for those areas in the Tepee Butte Project.

WATER RESOURCES

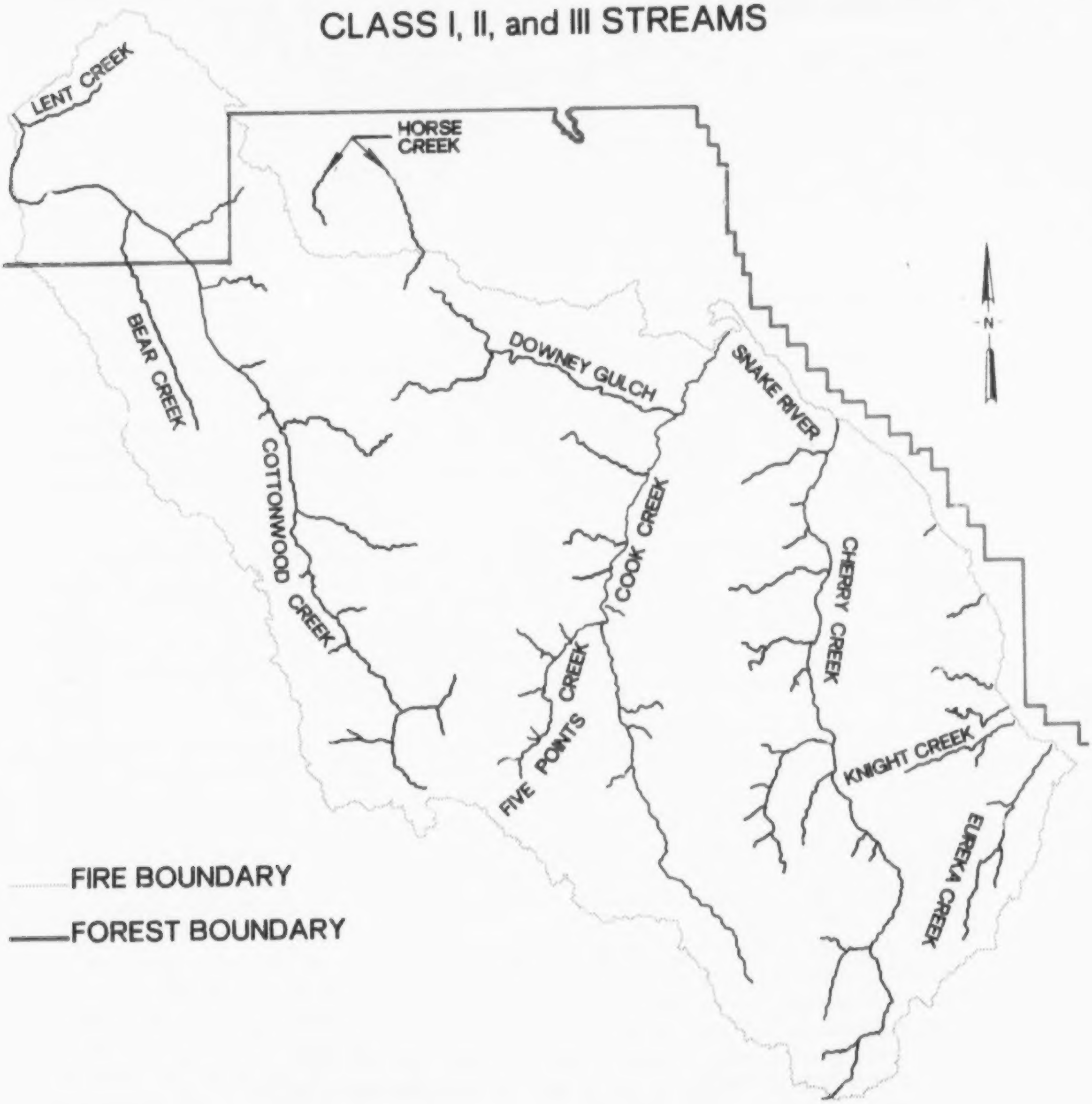
Fire removes protective vegetation on hillsides and along streamcourses. Loss of vegetation and underlying organic litter can result in accelerated soil erosion and an increase of sediment entering streams. Loss of streamside (riparian) vegetation reduces stream shading, bank stability, and input of woody debris. Previous fires in similar areas have demonstrated that these impacts can have a major effect on water resources in both the short and long term.

Streams primarily affected by the Tepee Butte Fire include Cottonwood, Cook, and Cherry Creeks (see Figure III-9). A small portion of Horse Creek watershed (Cold Spring Creek) is also included in the project area, but was not burned intensely (less than 1 percent of the riparian vegetation was lost). Small tributary streams to the Snake River, including Eureka and Knight Creeks, suffered some low and moderate intensity burns of their riparian areas and the surrounding grass and shrub lands.

Cottonwood Creek, a tributary to Joseph Creek in the Grande Ronde River watershed, provides habitat for resident trout and steelhead trout, an anadromous species. Horse Creek, which flows into Cottonwood Creek, also has steelhead and resident trout downstream from the wildfire area. Cook and Cherry Creeks, tributaries to the Snake River, may support populations of redband trout, a fish listed with the U. S. Fish and Wildlife Service as needing further study. Eureka and Knight Creeks are not known to contain fish. See the "Fisheries" section in this chapter for a complete description of the fisheries resources.

Streams on National Forest lands are classified according to their beneficial uses. Cottonwood, Cook, and Cherry Creeks have Class I stream sections due to their importance for anadromous and resident fish spawning and rearing. These Class I streams are managed to essentially prevent any degradation of water quality according to direction in the Forest Service Manual. In total, 24 miles of Class I streams exist in the project area. There are also 14 miles of Class II streams, which support moderate fish populations and contribute significantly to water quality in the Class I streams. Class III streams, which include all other watercourses having a year-round flow, total 53 miles in length within the project area. An intricate network of intermittent (Class IV) streams, 593 miles, contributes water to the

III-9 STREAMS MAP



CLASS I, II, and III STREAMS

LENT CREEK
HORSE CREEK
BEAR CREEK
DOWNEY GULCH
SNAKE RIVER
COTTONWOOD CREEK
COOK CREEK
CHERRY CREEK
FIVE POINTS CREEK
KNIGHT CREEK
EUREKA CREEK
N
FIRE BOUNDARY
FOREST BOUNDARY

system mostly during periods of snowmelt runoff or significant rainfall. Water resources in the project area also include numerous seeps and springs; some have been developed as water sources for livestock or recreational use.

Sediment, turbidity, stream temperature, and dissolved oxygen are the primary water quality parameters affected by the fire. State of Oregon water quality standards that have been developed for turbidity, temperature, and dissolved oxygen apply to waters in the project area. Other potential fire effects include changes in peakflows and summer lowflows. While these parameters have not been directly measured prior to the fire, they can be estimated using scientific models applicable to the project area.

Pre-fire Watershed Conditions

Alder, willow, and other deciduous vegetation dominate the riparian areas from the stream mouths upstream to about 2300 feet elevation. From 2300 to 2800 feet in elevation a mixed deciduous/coniferous stand inhabits the streamsides in the intermediate reaches. Grand fir, Douglas-fir, and other conifers dominate from about 2800 feet elevation to the headwaters. Small stringer meadows with willow may occasionally interrupt the conifers in the upper reaches. Before the fire, riparian vegetation along the Class I, II, and III streams provided 90-100 percent shading over the stream channels. These channels are typically 1-7 feet wide during the critical summer low flow period.

Livestock grazing, which directly affects watershed conditions, has been an important historic use of the project area. Cook and Cottonwood Creeks are in active cattle allotments, and Cherry Creek is in a sheep allotment that has not been grazed for the past two years. Cattle displaced by fire damage in 1986 used parts of the Cherry Creek allotment in the spring of 1987 and 1988. The overall condition of these three watersheds has improved since a period of overgrazing in the early 1900s. However, riparian areas are very attractive to livestock and often receive a disproportionate amount of use. For example, the Cottonwood Creek riparian area between Basin and Bear Creeks is in relatively poor condition due to excessive livestock use.

A road leading to the Cherry Creek Ranch site is located partially in the riparian management zone of Cherry Creek. Other roads in the project area tend to follow ridges, where impacts to the streams are minimal.

Pre-fire timber harvest was limited to salvage of diseased and windthrown trees in the relatively gentle terrain of the upper portion of the three watersheds. The steeply incised, lower portions of the watersheds have been allocated to uses that largely preclude timber harvest.

Annual peakflows typically occur during spring snowmelt, often accompanied by rain. High intensity summer thunderstorms occasionally produce highflows in localized areas. After spring snowmelt, summer lowflows persist in Class I, II, and III streams through September until fall rains replenish the area's water supply.

Post-Fire Watershed Conditions

Obtaining pure water quality and reliable water quantities depends upon the condition of the drainage basins surrounding stream channels. The fire altered the ability of the soil to absorb and retain water. It also changed the amount of vegetation available to take up water from the soil, provide a stabilizing root mass, intercept snow and rain, and shade the stream channels. The magnitude and significance of these changes on water quality/

quantity and fish habitat depend, in turn, on the existing soil, geology, topography, and the timing, volume, and duration of major rainfall and snowmelt runoff events. These fire-caused changes will greatly affect the way future land-impacting projects are designed and implemented.

Figure III-20 shows four categories of burn intensity for the project area. Figure III-10 shows the proportion of Cherry, Cook, and Cottonwood watersheds that burned at various intensities.

The important uses of water in the entire Grande Ronde River basin are listed as "beneficial uses" in "Regulations Relating to Water Quality Control in Oregon", Oregon Administrative Rules, 340-41-722. The "beneficial uses" specifically applicable for the Tepee Butte analysis area are:

* livestock watering
* salmonid fish rearing
* resident fish and aquatic life
* fishing (minimal)
* aesthetic quality
* anadromous fish passage
* salmonid fish spawning
* wildlife and hunting
* water contact recreation (minimal)

The majority of these beneficial uses are detrimentally affected by wildfire and future consequences have yet to be realized. However, livestock watering, anadromous fish passage (as affected by water quality), wildlife and hunting, and water contact recreation will not be affected by the fire. As such, those beneficial uses affected by the fire also have the potential for being further affected by activities associated with the proposed alternatives. The lingering fire effects and the effect on beneficial use are described in Chapter IV in the Water Resources and the Fisheries sections.

Water Quality -- This section includes a discussion of sediment, turbidity, stream temperature, dissolved oxygen and other constituents. Sediment, turbidity, temperature, and dissolved oxygen are factors that have the potential for being further affected by activities associated with the proposed alternatives -- the "other constituents" group does not. Sediment, turbidity, and temperature each relate to issues described under Water Quality/ Fisheries found in Chapter I. Further discussion on how changes in these factors were determined is found in Appendix B.

Sediment -- Where the fire removed the protective layer of vegetation and litter covering the soil, accelerated surface erosion will occur. Sediments will be transported to stream channels by overland sheetflow and by concentrated runoff flowing through small channels on the soil surface. Sediment will be stored temporarily in some ephemeral Class IV streams and then flushed to the main channel during rainstorms and snowmelt runoff. Sediment will also be stored on hillsides or in dry channels behind fallen logs, where it will be held in place by invading vegetation instead of washing farther downstream. Sheet and rill erosion will likely be the major modes of soil transport to stream channels. The geologic conditions in the project area are such that mass soil movement is unlikely.

Simulation models were used for determining soil erosion rates and sediment amounts delivered to the closest streamcourse and to analysis points downstream. The model indicates the sediment yields shown in Figure III-11.

Figure III-10 **Burn Intensity by Percent, In Cherry, Cook and Cottonwood Watersheds.**

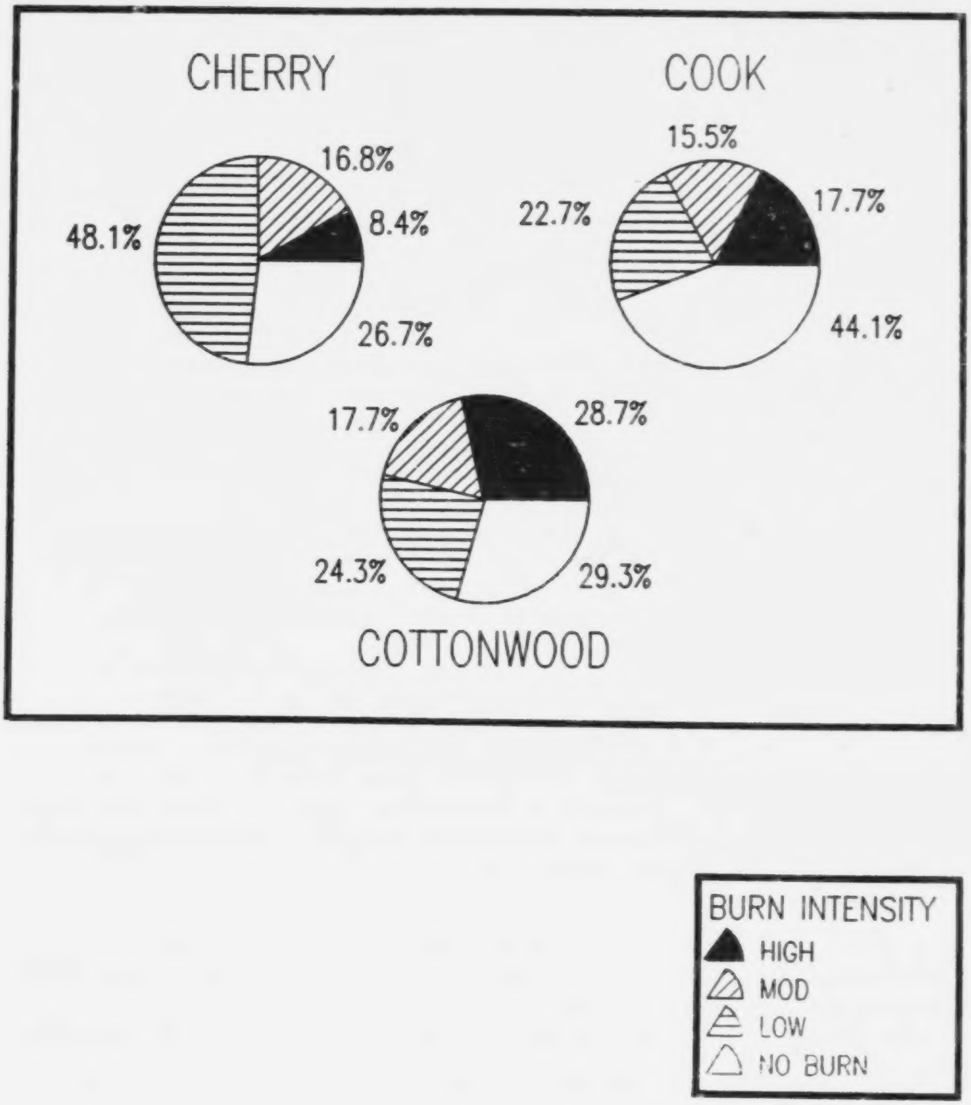


Figure III-11 Sediment Yield by Watershed

Watershed	Section	Sediment Yield (ton/square-mile/year) Pre-fire	Sediment Yield (ton/square-mile/year) Post-fire
Cottonwood	lower	21	73
	middle	15	56
	upper	0.3	10
Cook	mouth	30	78
	middle	12	72
	upper	3	8
Cherry	mouth	28	51
	middle	18	52
	upper	2	9

Turbidity -- The increased sediment load described above will result in increased stream turbidity (cloudiness). Increased turbidity will primarily degrade the aesthetic quality of water and during very high levels will damage the gill structure of fish and amphibians. Annual increases in turbidity will occur at approximately the same time in the same amounts as the sediment yield described above.

Stream Temperature -- Loss of vegetative stream shading as a result of the fire will significantly increase maximum daily water temperatures as well as the range of daily fluctuations. Figure III-12 shows the riparian management zones along Class I, II, and III streams in each watershed which were affected differently by varying burn intensities.

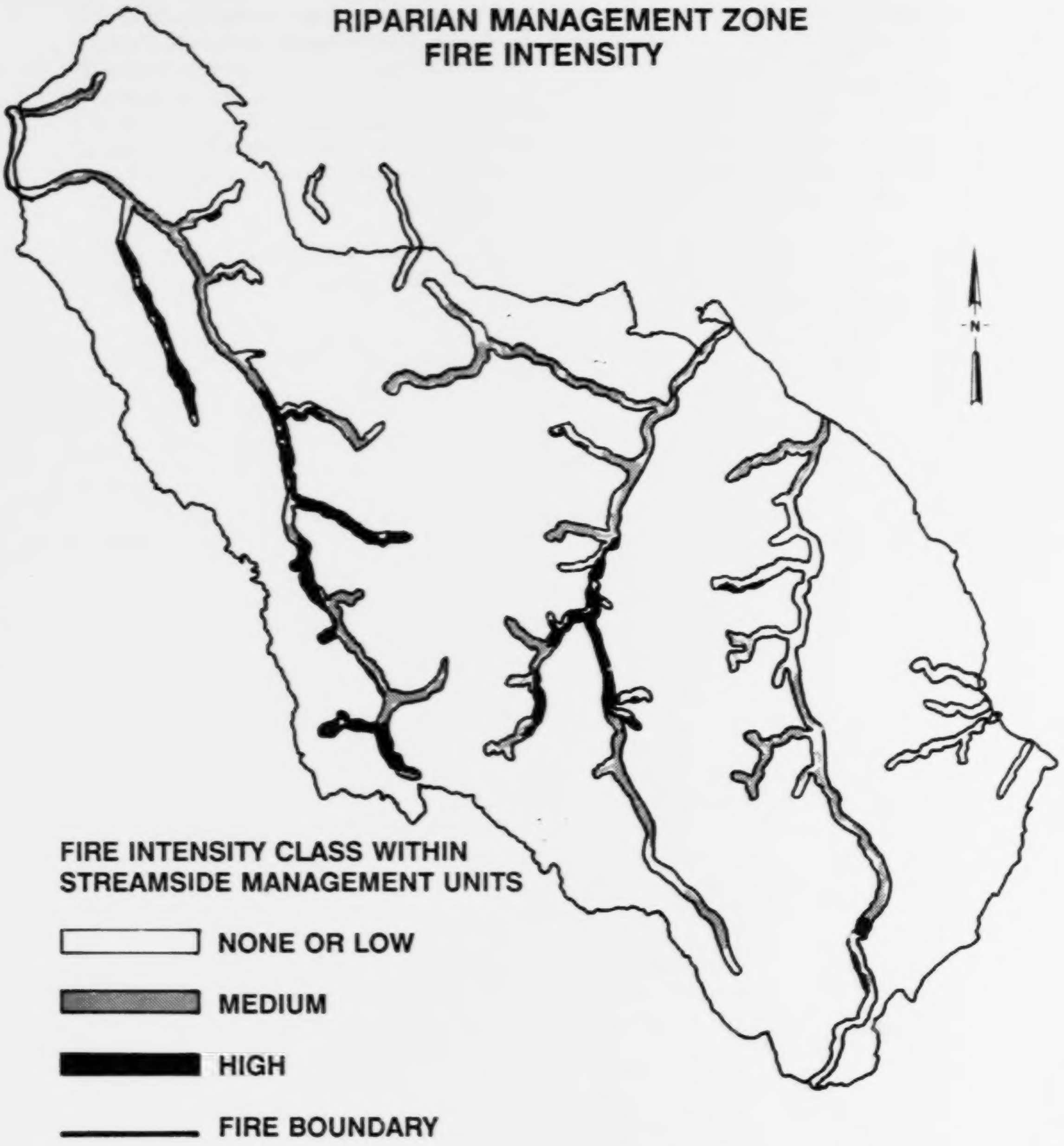
As shown in Figure III-10 the three watersheds were not equally affected by the fire. For the purpose of this discussion, the magnitude of vegetative shade loss is assumed to be greatest in riparian areas having the highest burn intensities. The Cherry Creek riparian area was lightly impacted, only 19 percent of the riparian vegetation was within a moderate or high intensity burn. The fire burned hotter in Cook Creek, where 58 percent of the riparian vegetation suffered a moderate- or high-intensity burn. Cottonwood Creek drainage was the hardest hit, 75 percent of the riparian vegetation was in moderate- or high-intensity burn areas. Riparian vegetation in Eureka and Knight Creeks consists mostly of deciduous shrubs which are expected to recover quickly from the fire.

State of Oregon water quality standards for temperature specify that no measurable increases shall be allowed from planned activities when existing stream temperatures are 68 degrees F or higher. Cottonwood, Cherry, and Cook Creeks are expected to exceed 68 degrees F in the summer of 1989 due to loss of shade from fire-killed vegetation.

Where the vegetation is mostly willow and alder, sprouts from root crowns and lateral suckers extending from roots should result in a fairly rapid regrowth of vegetation in areas of low- and moderate-intensity burns. Even in high-intensity burn areas, deciduous vegetation should recover and provide pre-fire shading conditions within ten years. Where conifers dominate the riparian vegetation, however, shade recovery will be slower (more than 10 years). Shrubs are expected to colonize these sites now that the tree canopy has been opened up by the fire.

III-12
RMZ MAP

RIPARIAN MANAGEMENT ZONE FIRE INTENSITY


N
FIRE INTENSITY CLASS WITHIN STREAMSIDE MANAGEMENT UNITS
NONE OR LOW
MEDIUM
HIGH
FIRE BOUNDARY

Dissolved Oxygen -- Atmospheric oxygen dissolved in stream water is an important life requirement for fish and other aquatic organisms. Primarily because of increased stream water temperatures brought about by the loss of shade, dissolved oxygen levels will be much reduced -- the warmer the water, the less oxygen it can contain. Another less important reason (for the Tepee Butte stream environment) for reduced dissolved oxygen levels is the expected occurrence of dead tree needle drop into streamcourses. This input of organic matter provides a medium for microorganisms to live on, expand in numbers, and utilize/remove oxygen from the stream water. This latter factor will probably reduce oxygen in small (few feet wide) backwater areas. However, stream turbulence will rapidly restore dissolved oxygen back to maximum saturation levels as soon as water is flushed through the areas.

Figure III-13 shows representative dissolved oxygen levels for project area fish producing streams. These are the maximum levels that the stream can and will hold for maximum stream temperatures that are expected to occur.

Figure III-13 Dissolved Oxygen by Watershed

		Dissolved Oxygen (milligrams/liter)	
Watershed	**Section**	**Pre-fire**	**Post-fire**
Cottonwood	lower	8.4	7.0
	middle	9.4	6.7
Cook	mouth	9.5	7.2
	middle	9.5	6.6
Cherry	mouth	9.1	8.8
	middle	9.8	8.4

Other Constituents -- In light of scientific research, water quality constituents such as pH, electrical conductivity, bacteria, heavy metals, nutrients, and introduced chemicals are not likely to be substantially changed by the fire or by associated recovery project activities. Temporarily elevated levels of nitrogen and phosphorus compounds may occur due to accelerated sedimentation. Increased algal production associated with these nutrients and increased water temperatures could occur in backwater areas.

Water Quantity -- This section includes a discussion of peakflow, both snow and rain generated, and total annual flow. Of these three topics, only rain generated peakflow has the potential for being further affected by activities associated with the proposed alternatives. Peakflow relates to water quantity identified as an issue under Water Quality/ Fisheries found in Chapter I. Further discussion on how peakflows were determined is found in Appendix B.

Loss of forest cover due to the fire should result in higher peakflows. The loss of tree canopy will reduce the amount of rain and snow intercepted, reduce the amount of soil moisture evaporated and transpired, and reduce the shading of snowpacks. Increased snow will accumulate in the new openings, melting off more rapidly in the spring as compared to snow under the previous canopy. Snowmelt runoff will have greater volume and occur earlier in the year than during pre-fire conditions. The magnitude of the highflows which actually occur will be influenced by the depth of the snowpack, air temperature, wind speed and direction, and amount of rainfall on snow in the spring.

A streamflow prediction model was used to simulate snowmelt-generated peakflow behavior on the Tepee Butte watersheds. The model shows the peakflow changes due to wildfire as seen in Figure III-14.

Figure III-14 Snowmelt-Generated Peakflows by Watershed

Watershed	Section	Snowmelt-Generated Peakflow Increase Relative to Pre-fire (Percent)
Cottonwood	lower	19
	middle	29
	upper	24
Cook	mouth	9
	middle	21
	upper	29
Cherry	mouth	5
	middle	10
	upper	20

These increased levels will only change a few percentage values during the 10-year watershed analysis period. Even if trees were immediately re-established in all burned areas, they would not be tall enough or dense enough in 10 years to significantly change snowmelt and soil water use rates. After trees have become established within the tree-loss areas, 30 to 50 years will be needed, depending on plant association, before snowmelt rates, soil water use, and peakflow increases associated with each area return to pre-fire (almost pristine) conditions.

High-intensity, rainstorm-generated peakflows will also be greater than pre-fire levels due to the reduced infiltration rate and water-holding capacity of the soil. The increase from areas larger than a few hundred acres could not be determined because no appropriate simulation model or peakflow data exists for Tepee Butte or a similar area.

Total annual streamflow, including summer lowflows, will also increase due to the reduction in soil water use caused by loss of forest cover.

Watershed Rehabilitation -- Watershed rehabilitation efforts commenced before the autumn rain and snow of 1988. To quickly re-establish vegetation and reduce soil erosion, nearly 200,000 pounds of grass seed was aerially applied over 12,617 acres. Riparian areas and slopes that received moderate to high intensity burns received priority in the seeding effort.

FISHERIES

Pre-Fire Fish Habitat Condition

Three fish-bearing streams (Cottonwood, Cook, and Cherry) flow through the recovery project area. Cottonwood Creek, a tributary of Joseph Creek in the Grande Ronde River basin, provides habitat for anadromous steelhead and resident rainbow trout. Within the project area, the stream offers little sportfishing due to its small size, but contributes significantly to the downstream sport fishery. Cook and Cherry Creeks, tributaries of the Snake River, have barrier falls in their lower reaches blocking access for anadromous fish. Resident fish above these falls are thought to be redband trout, classified as Category 2 (a species needing further study) by the U.S. Fish and Wildlife Service under the Threatened and Endangered Species Act. The value of these populations lies in their genetic uniqueness. Small stream size and difficult access limit sportfishing in Cook and Cherry Creeks.

Although some minor poor riparian conditions existed on lower Cottonwood Creek, the three entire watershed areas were in excellent condition before the fire. The pre-fire watershed condition and summary of historic impacts are described in this chapter in Water Resources. Water quality in these streams was also excellent. Evaluation of pre-fire aerial and infrared photographs supports the evaluation of the fish sampling done November 7-11, 1988, and indicates the three streams were 95 percent shaded.

The sampling revealed only trout and steelhead populations. The absence of any non-game fish, such as dace, shiners, or suckers, indicates excellent water quality and cool stream temperatures. The fish found in November are representative of pre-fire populations. Trout densities were relatively high, indicating these streams were fairly productive, although the number of samples was not large enough to make quantitative estimates of total stream production.

Fish habitat data from the November 7-11, 1988, field survey and Oregon Department of Fish & Wildlife physical and biological surveys (1966) are summarized below.

Cottonwood Creek--Characteristics of Cottonwood Creek are: moderate, uniform stream gradient, low pool-to-riffle ratio (1:5), rubble/boulder substrates, narrow stream floodplain with steep sideslopes, numerous small springs, and abundant woody debris. Winter distribution of juvenile salmonids, determined by electrofishing, extended about 4.3 miles upstream from the confluence with Joseph Creek.

Cherry Creek--Cherry Creek riparian overstory was near 100 percent. Total stream length is approximately 8.7 miles changing from deciduous to coniferous vegetation at about 6.7 miles upstream. From there to the headwaters dense timber with little understory dominated. Stream habitat is characterized by: moderate, uniform gradient (2-5 percent), low pool-to-riffle ratio (1:3), rubble/boulder substrates, little woody debris in lower reaches, and abundant woody debris in upstream forested areas. An impassable waterfall (30 foot vertical drop) is found 0.2 miles from the Snake River confluence.

Cook Creek--Drainage characteristics of Cook Creek are similar to Cherry Creek. Watershed conditions before the fire were good overall. Stream length is approximately 8.3 miles with a general transition from deciduous to coniferous vegetation at about 5.9 miles from the stream's mouth. Habitat is characterized by: moderate uniform gradient (2-5 percent), pool-to-riffle ratio of 1:3, rubble/boulder substrates, little woody debris in lower reaches, and abundant woody debris in upper forested areas. An impassable waterfall (20-foot vertical drop) is found 0.6 miles from the Snake River confluence.

Post-Fire Fish Habitat Condition

The most important changes within the fire recovery area affecting fish habitat quality will be water temperature and sediment deposition increases, changes in flow patterns, and amounts of in-stream large woody debris (LWD).

The greatest impact from the fire to water quality and fish habitat is generally related to the amount and intensity of the riparian area burned. Generally speaking, the higher the burn intensity, the more shade is lost, and the time to re-establish shade will be longer. Loss of binding root strength results in decreased channel stability, and sediment deposits will be greater due to lost vegetative ground cover. For a summary of burn intensity in the riparian areas and changes in water quality as a result of the fire see Water Resources in this chapter. In general, about 75 percent of the riparian area along Cottonwood Creek, about 60 percent of Cook Creek, and about 20 percent of Cherry Creek burned with moderate-to-high intensities.

Warmer water temperatures resulting from shade loss along the streams will adversely affect habitat quality for trout and steelhead. Water temperatures above 68 degrees F stress these species, resulting in lower growth rates, higher susceptibility to disease, and poorer overall health and condition. In Cottonwood Creek, no barriers prevent non-game species from moving into the area. These non-game species, which are more competitive than salmonids in warmer water, are expected to move into Cottonwood Creek in the next few years when water temperatures elevate. This interspecies competition will likely result in an additional or secondary impact on the trout and steelhead in Cottonwood Creek, but is not expected to occur in Cook and Cherry Creeks above the barrier falls.

Higher sediment transport from the side slopes to the stream channel is expected to increase the percent of fine sediment existing in the stream substrate. This will adversely affect both egg/embryo development and fry rearing habitat. The fine sediment will also reduce intergravel water flow, which in turn impedes development of the egg to fry stage occurring in the gravel. At higher levels, this can result in deformities and death.

The higher peakflows expected to result from the fire will increase channel erosion. This will add even greater amounts of sediment to affected streams.

The streams displayed no major loss of LWD after the fire. By November 1988 levels of LWD in high intensity burn areas of Cottonwood Creek had increased significantly due to blowdown. An increase of LWD in the streams is expected to occur over the next several years. Some trees will fall directly into the stream channel; others will be suspended across the stream until they collapse into the channel.

Of particular importance to fish habitat, LWD creates plunge pools, important for rearing habitat. Spawning gravel is often associated with these pools. Thus, the increase of LWD will tend to improve some components of fish habitat in these streams. However, this short-term increase could be followed by a sharp downfall of available LWD, depending on the percent of trees killed in the riparian areas; the rate at which trees fall, deteriorate, break up and are transported out of the system; and the growth rates of regenerated stands that will begin cycling LWD into the stream again.

WILDLIFE HABITAT

Wildlife diversity and habitats are dependent on a diverse vegetative community. The more variety within the plant community, the more varied wildlife habitat is available, particularly for edge-dependent species. Thus, when an event affects the plant community, it touches the animal community also. The fire altered the structure and composition of vegetation in the project area and returned it to an earlier seral stage.

The project area contains habitat for approximately 250 bird species. Some of the more common examples include: California quail, mountain quail, chukar partridge, mountain quail, ruffed grouse, blue grouse, mourning dove, downy woodpecker, dark-eyed junco, canyon wren, raven, and many songbirds. There are also endangered species such as bald eagles and American peregrine falcons.

Exclosures protect sensitive areas.

Approximately 80 mammal species reside in the project area. The following species are most common: squirrel, chipmunk, mule deer, Rocky Mountain elk, black bear, cougar, Rocky Mountain bighorn sheep, bobcat, coyote, raccoon, mink, otter, badger, beaver, and numerous species of rodents. Ten resident amphibian species and 12 reptile species are also known to frequent the area; however, only the tailed frog has been seen during post-fire surveys.

Generally, wildlife habitat diversity decreased in the steep terrain where hot fire conditions resulted in a complete burn. Conversely, habitat diversity increased on the flatter ground where a mosaic of vegetation was created. This increased the quantity and quality of forage and edge habitat for many game and non-game species.

Whether the fire eliminated any species from the project area is not yet known. Habitat is still available and in some cases is improved because of the fire. Game species that are presently absent from the project area will likely return in the spring of 1989 when greenup occurs.

The Forest Service manages habitat for all wildlife species. Several groups have special habitat requirements. They include: 1) popular game species, usually dependent on edge habitat or open grasslands; 2) species requiring early, mature, or old growth forest conditions; and 3) species dependent on specialized habitat conditions, such as cavity nesters.

Indicator Species

Five species on the Wallowa-Whitman National Forest have been classified as Management Indicator Species (MIS). These MIS's represent all other wildlife utilizing similar habitats (Figure III-15). By monitoring the health and populations of the indicator species, trends for the relative well-being of groups of animals can be estimated (USDA; DEIS Wallowa-Whitman NF, 1986). Indicator species are animals which are commonly hunted or represent special habitats.

Figure III-15 Wildlife Indicator Species and Habitat

Species	Habitat
Rocky Mountain elk *	Early successional forest stages
Goshawk **	Old Growth and mature forest
Pileated woodpecker **	Old Growth and snags
Black-backed three-toed woodpecker **	Snags
Northern three-toed woodpecker **	Snags

* Selected because it is commonly hunted.

** Selected because it represents special habitat.

Rocky Mountain Elk - Edge Habitat--Both mule deer and Rocky Mountain elk occupy the project area in near equal numbers, but Rocky Mountain elk is the indicator species. Edge habitat includes conifer cover intermixed with either early successional stage forest or natural grasslands. Optimal habitat requires a forage to cover ratio of 60:40.

Rocky Mountain elk are classified as Management Indicator Species representing other wildlife species that utilize similar habitats.

Pileated Woodpeckers and Goshawks - Old Growth--These two bird species are used by the Forest Service as indicator species for mature and old growth habitat. Pileated woodpeckers require dead and down trees as foraging habitat. Typically they spend two-thirds of their time feeding by excavation and one-third scaling bark in search of insects (Schroeder 1983). Suitable nest trees for pileated woodpeckers must be more than 20 inches dbh. They also prefer to nest in two-storied timber stands with a crown closure of approximately 70 percent, including both overstory and understory (Bull 1975).

Goshawk nest sites in Oregon are associated with forest stands of different ages. They reproduce in coniferous or deciduous trees and feed in trees and shrubs or in flight. Goshawks use down logs as sites on which to pluck feathers or fur from prey. They also use cliffs and talus areas for feeding sites (Thomas 1979).

Northern and Black-backed Three-toed Woodpeckers - Snags--Both the northern and black-backed three-toed woodpeckers use 40-year-old-plus timber for reproduction and feeding. The northern three-toed woodpecker prefers lodgepole pine and subalpine fir communities. The black-backed three-toed woodpecker prefers mixed conifer, grand fir, lodgepole pine, and subalpine fir communities.

Clumped snags in small patches enhance the nesting habitat of both species of woodpeckers. A variety of woodpeckers, owls, and bats utilizes snag habitats.

Post-fire Effects

Where fire intensities were high or moderate, both marginal and satisfactory vegetative cover was destroyed, but at the same time nature's process for developing an abundance of high-quality forage was set in motion. Approximately 37 percent of the timbered areas burned at high intensities and 32 percent at moderate intensities.

On lightly burned areas, cover was reduced in quality. The effects of light burns depend somewhat upon the species composition of a particular stand. In the grand fir community type, a high tree mortality rate is expected, consequently reducing or eliminating it as cover. In the ponderosa pine, Douglas-fir and western larch community types, low tree mortality rate is expected, thus their cover value will be maintained. Approximately 22 percent of the timber area was lightly burned.

Following the fire, 12,617 burned acres were seeded with annual and perennial grass species for erosion control purposes. In addition to increasing soil stability, these grasses will increase forage quality for big game for 1-2 years while native vegetation begins to recolonize the burned sites.

Habitat Effectiveness Index

The Habitat Effectiveness Index (HEI) was created as a habitat measuring device for Rocky Mountain elk, the indicator species for edge habitat species. The HEI model is composed of ratings for the quality of cover and forage combined with the effect of roads open to motorized traffic. HEI is used to monitor change in wildlife habitat. In this DEIS, it is used to show changes resulting from the fire and implementation of alternatives. Prior to the fire, the area's HEI was 76.2. Post-fire HEI is 63.4 The drop in HEI from pre-fire to post-fire is directly attributed to the loss of and poor spacing of cover. HEI can be used as an indicator of changes for all wildlife species using this habitat type.

Specific Habitats

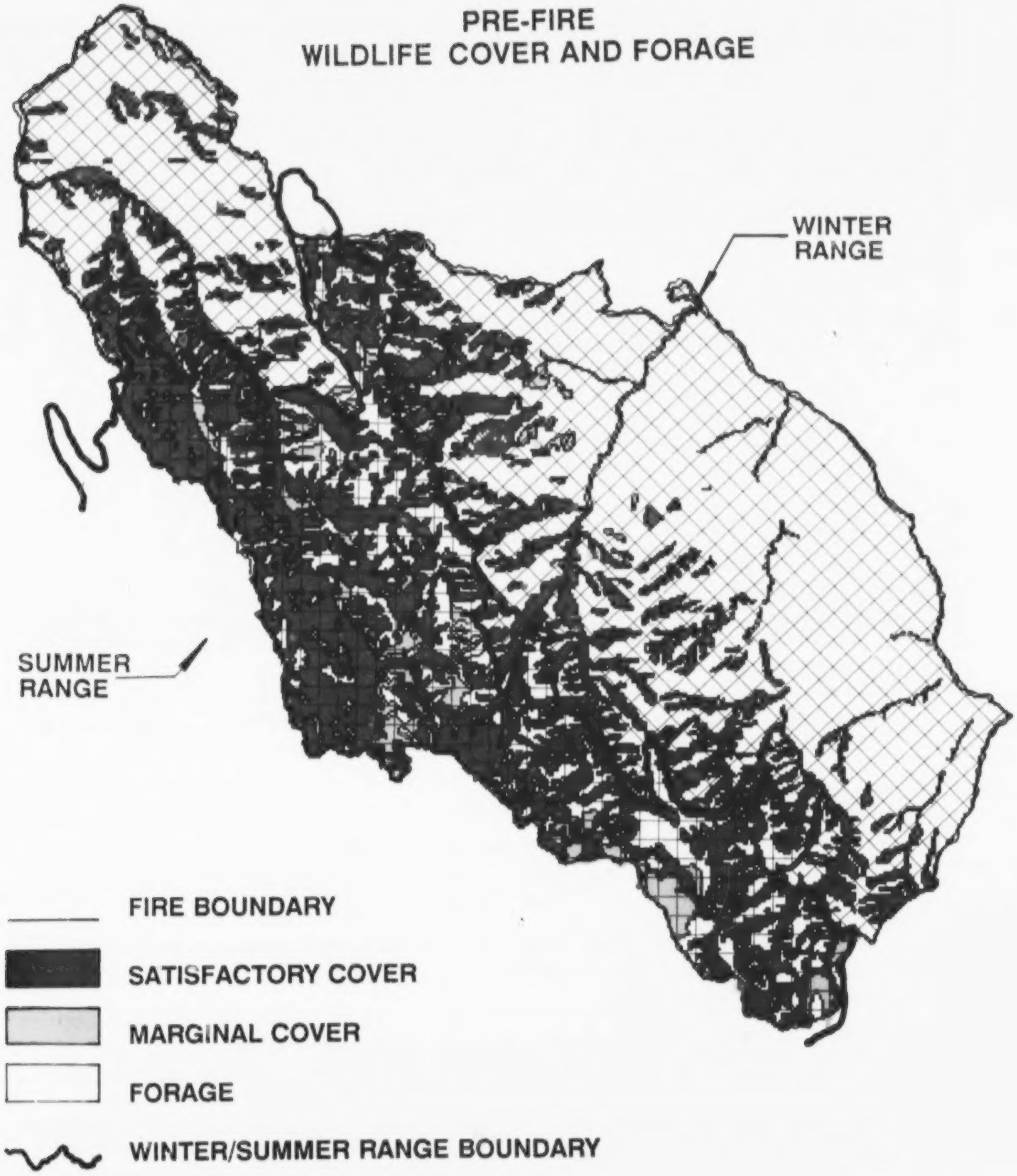
Elk Habitat--The winter range on the project area contained 7,192 acres of satisfactory cover and 643 acres of marginal cover before the fire. It now contains 1,568 acres of satisfactory and 1,009 acres of marginal cover.

The summer range contained 11,402 acres of satisfactory cover and 1,436 acres of marginal cover before the fire. It now has 4,058 acres and 2,511 acres of satisfactory and marginal cover respectively.

The pre-fire and post-fire forage/cover ratios are 65/35 and 85/15 respectively. (See Figure III-16 for Wildlife Pre-fire Cover Map and Figure III-17 for Wildlife Post-fire Cover Map.)

As a result of these changes, some elk have been displaced but are likely to return in the spring of 1989 when greenup occurs.

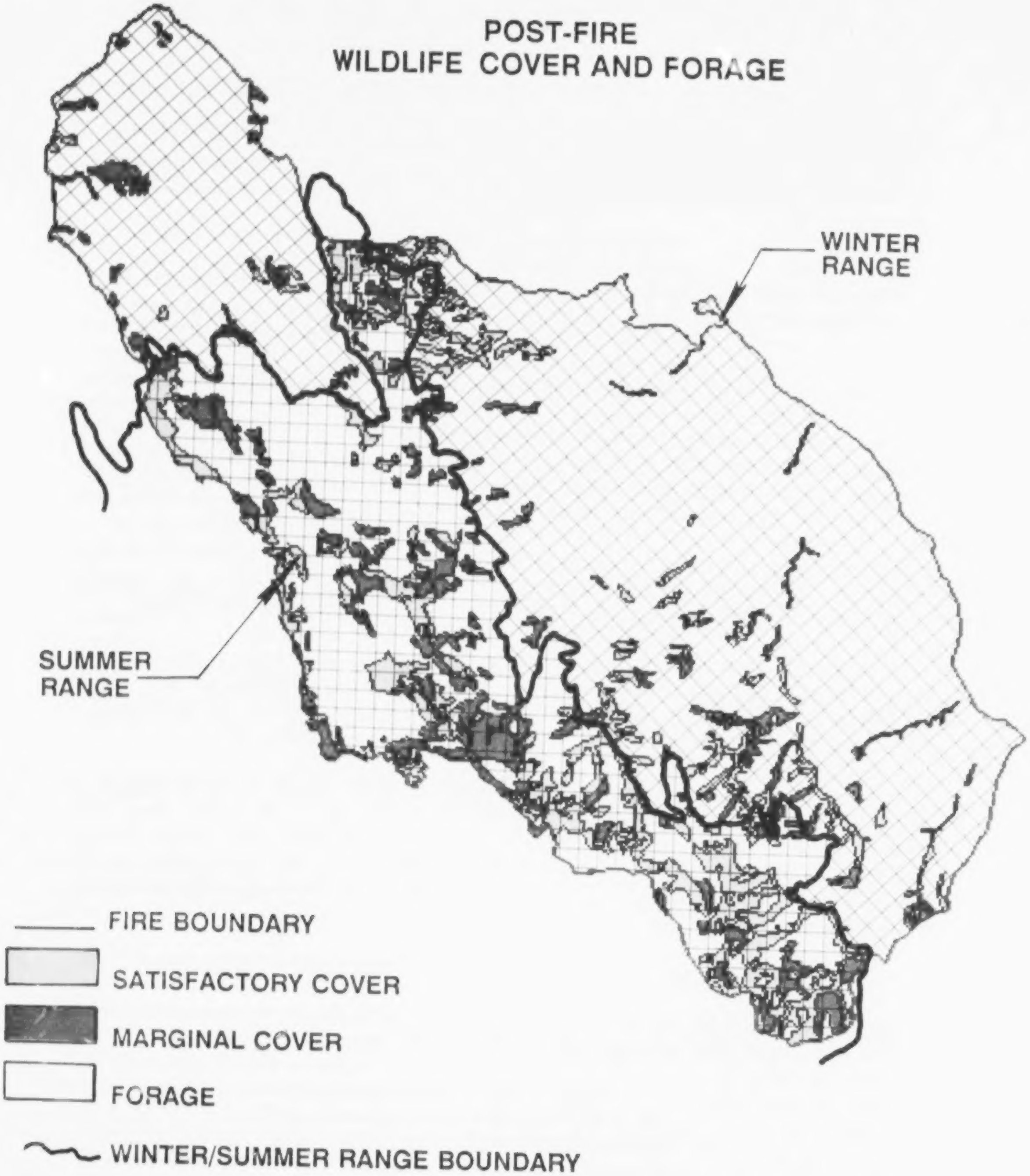
FIGURE III-16



PRE-FIRE
WILDLIFE COVER AND FORAGE

WINTER RANGE
SUMMER RANGE
FIRE BOUNDARY
SATISFACTORY COVER
MARGINAL COVER
FORAGE
WINTER/SUMMER RANGE BOUNDARY

FIGURE III-17



POST-FIRE
WILDLIFE COVER AND FORAGE

WINTER
RANGE
SUMMER
RANGE
FIRE BOUNDARY
SATISFACTORY COVER
MARGINAL COVER
FORAGE
WINTER/SUMMER RANGE BOUNDARY

Old growth--The project area contained 17,171 acres of mature and old growth forest habitat prior to the Fire. This represented 29 percent of the total project area. It now contains 2,142 acres of this habitat. Figure III-18 is a breakdown of the different management areas and their pre- and post-fire acreages of old growth and mature habitat.

Figure III-18 Mature and Old Growth Forest Habitat Acres

	Pre-fire	Post-fire
Dispersed Recreation/Native Vegetation (DR/NV)	7,871	787
Forage	4,286	149
Dispersed Recreation/Timber Management (DR/TM) (Old growth)	5,014	1,206

Ten percent of the timbered area in the DR/TM allocation must be managed for designated old growth. The unburned and low-burn-intensity areas are included in the above post-fire acres. The moderate- and high-burn-intensity areas no longer meet the old growth definition and are not included in the post-fire acres. Of the designated old growth in the DR/TM allocation, 191 acres burned with light intensities, 55 acres burned with moderate intensities, 313 acres burned with high intensities, and 27 acres did not burn.

With the drastic reduction in the amount of mature and old growth timber type, the total numbers of animals using this habitat type will be reduced. However, viable breeding populations of each species should still remain, with some relocation of territories.

Throughout the mature and old growth habitat in the lightly burned areas, resprouting of ground vegetation will occur quickly and populations of small mammals will also quickly recover. Although no goshawks have been observed in the project area since the fire, a viable population is still expected. Pileated woodpeckers are still present.

Snags--As a result of the fire, habitat capability (number of snags) for woodpeckers exceeds 100 percent of potential habitat throughout the project area. Fire-killed (hard) snags are expected to remain standing for an average of 20 years. The number of snags is expected to increase as damaged trees die in the future. The DR/TM area is being managed to maintain snag habitat at 60 percent of maximum woodpecker population (Thomas 1979).

Within the Forage Allocation, snag habitat is to be maintained at the 100 percent level.

The DR/NV area does not have a specific snag level to be maintained; however, from its description in the CMP, the 100 percent snag level is deemed appropriate.

The fire increased the number of dead trees, which will add large woody material to the forest floor in the future. Large woody material provides cover for small mammals which are a food source for owls and marten. The large woody material also provides habitat for insects which are a food source for birds.

Other Habitat Types

Riparian--Riparian zones can be identified by the presence of vegetation that requires free or unbound water or conditions that are more moist than normal (Thomas et al. 1979). Within the project area 553 acres of Class I, 318 acres of Class II, and 1,064 acres of Class III streamside areas are considered riparian zones.

Riparian habitat is particularly important where it provides connecting habitat and travel corridors for wildlife species moving between blocks of cover. Riparian areas provide diversity in plant species and structure, and are sought by wildlife for water and improved micro-climates during periods of summer and winter temperature extremes. Small mammal communities are more dense and diverse in riparian areas (Cross 1985).

Moderate-to high-intensity fire swept through 50 percent of the project area's riparian habitat. In areas that sustained very hot burns, all vegetative cover was killed, greatly reducing wildlife use. From a positive perspective, however, snags located near water have a higher degree of use. Dead vegetation also provides an element of hiding cover for a variety of animals. Because of water abundance and the large variety of woody species within this zone, revegetation is expected to occur more rapidly than in midslope zones. Streamside areas with soil stability problems will be slower to recover.

Rocky Areas--The grass, forb, and shrub component on rocky areas and the surrounding fringes should return to pre-burn levels within 2-15 years. It will take decades before trees of comparable size to those killed by fire are replaced. However, the live trees and snags presently remaining on these sites are now an important habitat component and will continue to enhance the use of these sites by wildlife. This community type is made up of 39,067 acres, or 65 percent of the total project area.

Unique wildlife habitats include talus, cliffs, and rock outcrops. Most of these areas burned; however, the basic structure of this habitat was not altered.

General populations of animals that prefer cliff and rock outcrops were not greatly affected by the fire. Those species which were affected are expected to return to pre-fire levels within 5 years.

SOILS RESOURCE -- LONG-TERM SITE PRODUCTIVITY

Soil is a fundamental, largely nonrenewable resource which must be conserved to assure high-level sustained yields of water and timber, adequate recreational opportunities and wildlife habitat, and the continued success of the project area's aquatic life.

Pre-Fire

Soils in the fire area have properties strongly influenced by area geology. Surface deposits of windblown (ash, ash-loess, loess), colluvial, or residual material also influence soil development. The variable nature of the soils in the project area is common to the region. Soils on ridgetops and steep slopes are often moderately deep (20-40 inches to bedrock) with abundant rock fragments. Surface litter and duff layers, important for soil protection, moisture retention, and nutrient cycling, range from shallow to moderately deep. Deeper colluvial soils are found on shoulders, benches, and toeslopes. Soils with high clay content are found mainly in the non-forested areas and at lower elevations associated with the non-basalt bedrocks. Soil descriptions, characteristics, and management interpretations are listed in the Order-3 Soil Survey for the Tepee Butte Project which is on file at the Forest Supervisor's Office in Baker, Oregon.

Post-Fire

A mosaic of disturbed areas exists as a result of the different burn intensities, fire duration, and pre-fire vegetation. Overall, 16 percent of the analysis area burned with a high intensity, 17 percent burned with a moderate intensity, and the remainder was either unburned or burned with a low intensity. The high intensity burns, often on steep slopes, destroyed understory vegetation, litter, and duff. Many of the mature conifers were either killed or severely damaged.

Small amounts of litter and duff remain on the forest floor in the high-intensity and some of the moderate-intensity burned areas. Surface erosion is evident on steep slopes where mineral soils are exposed and where water has created channels through the soil. Remaining large pieces of woody material are heavily charred with a weather-resistant charcoal coating that slows the rate of natural decomposition and mineralization.

Hydrophobic (water-repelling) organic compounds that volatilized during combustion have coated soil particles. In some instances, the soil's water infiltration rate has been reduced by this water-repellent coating.

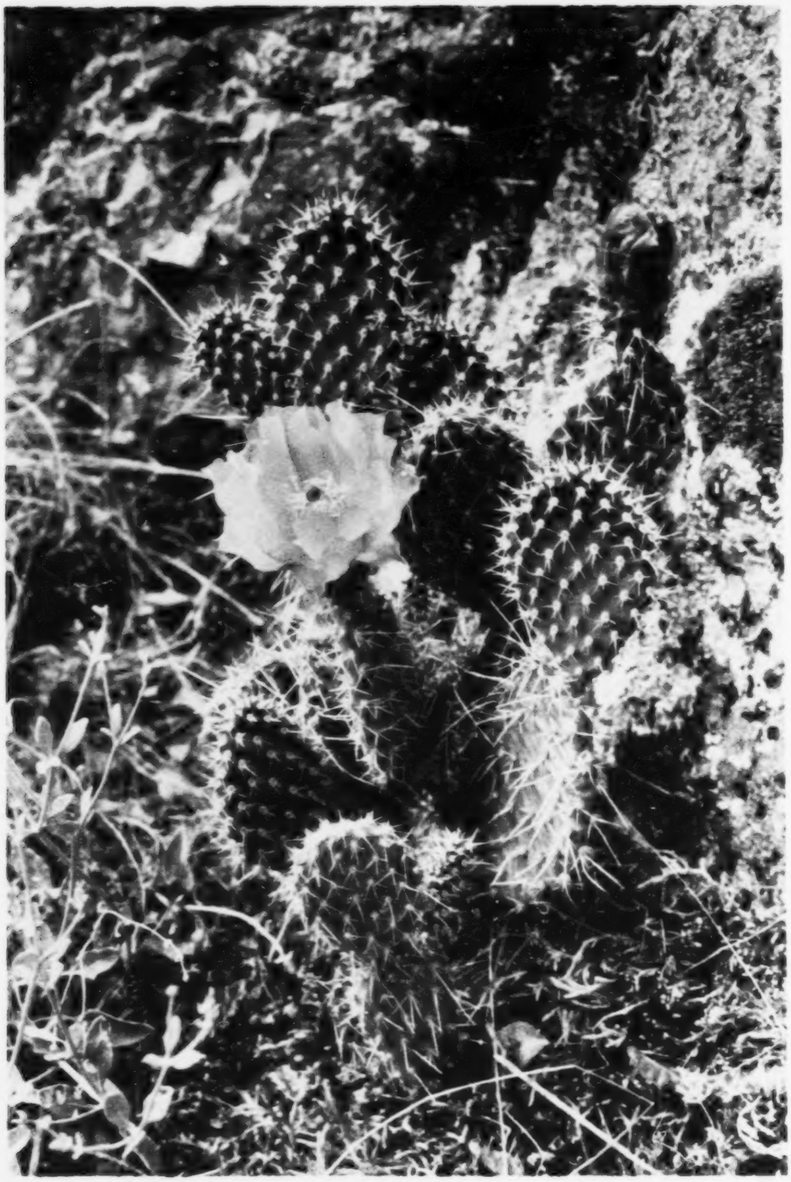
Areas of Special Concern

In the large continuous tracts where most of the overstory vegetation burned at high and moderate intensities, the potential for surface erosion has increased. Erosion is potentially significant where riparian vegetative filter strips have been destroyed.

Ephemeral streams, due to the loss of ground cover and a reduction in evapotranspiration rates, may now carry more water. This increase in water can result in stream channel erosion.

VEGETATION MANAGEMENT

For thousands of years, fire has been one of the most important periodic disturbances in ecosystems of the Pacific Northwest. Species composition, richness (diversity), and stand structure are primarily dependent on fire occurrence over time.



Prickly pear cactus (Opuntia polycantha) is one of the diverse plant species found in the Hells Canyon NRA.

In intensely burned areas, fire returns plant communities to an earlier seral stage, allowing an influx of pioneer species and sprouters at the expense of the more sensitive, climax, or late successional species. The vegetation of the project area has evolved with, and is a result of, intense periodic disturbances. Indeed, it relies on such events to maintain species diversity and ecosystem health.

Pre-Fire Conditions

Plant communities within the project area reflect the wide ranges in topography, elevation, precipitation, aspect, soils, and past disturbance (see Appendix J for more data on Plant Associations). Of the four major physiographic units (alpine, forested uplands, grass-shrub uplands, and valley lands), much of the project area falls into forest uplands and grass-shrub uplands.

The forested area is a naturally occurring mosaic pattern of stands created from damaging agents such as mistletoe and Indian paint fungus infections, mountain pine beetle and bark beetle infestations, and fire. These lands provide valuable habitat for numerous wildlife species and some recreation opportunities. The bulk of the commercial timber available for harvest comes from forested uplands.

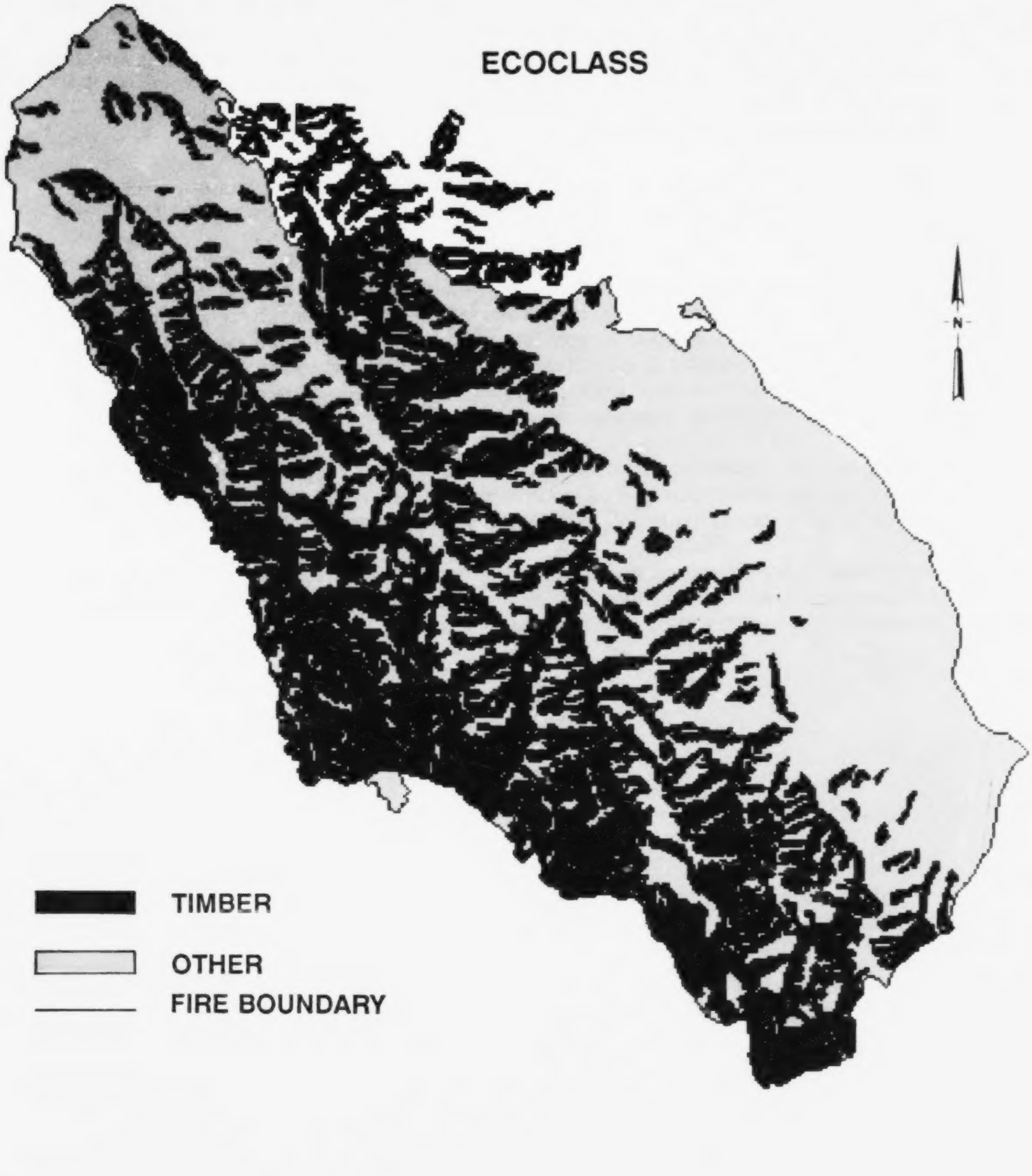
Coniferous tree species in the forested areas include Douglas-fir, grand fir, ponderosa pine, western larch, Engelmann spruce, lodgepole pine, and subalpine fir. Hardwood species include quaking aspen, willow, black cottonwood, alder, and Rocky Mountain maple. Major ground vegetation species are big huckleberry, snowberry, ninebark, queen's cup, twinflower, pinegrass, heartleaf arnica, spirea, vetch, mitella, pipsissewa, and Oregon anemone.

Major grassland plant associations are Idaho fescue/prairie junegrass, stiff sagebrush/ Sandberg's bluegrass, and Idaho fescue/bluebunch wheatgrass (see Vegetation Map, Figure III-19).

Post-Fire Conditions

The effects of the fire vary over the project area according to differences in fire intensity, duration, and pre-fire vegetative composition. Fire intensity has been mapped into four broad categories: (1) High Intensity, trees are black with no needles, or all needles have been heat scorched brown; (2) Medium Intensity, mixture of live and fire-killed trees; (3) Low Intensity, underburned situation with a few crown-scorched trees but generally no evidence of crown fire; and (4) No Burn (see Fire Intensity Map, Figure III-20). Primarily, the intensely burned portions of the project area occurred on the very steep canyons within the DR/NV and Forage allocations, and within the heavier volume, unlogged stands in the DR/TM allocation. It must be noted that in the low burn intensity category, tree mortality can be highly variable. Some low burn areas with small trees or thin-barked species may be 80-90 percent dead from ground-fire-caused, basal cambium girdling, yet the crowns and upper boles are not even scorched or blackened. The needles of these trees will start to turn brown during the hot part of the summer of 1989. Other low burn areas with large trees or thick-barked, fire-resistant species may be only 5-25 percent dead (see Mortality Class Map, Figure III-21).

FIGURE III-19



ECOCLASS

N
TIMBER
OTHER
FIRE BOUNDARY

The dead and severely damaged timber in the project area totals approximately 252 MMBF of gross volume on all land ownerships. The post-fire estimates are derived from fire intensity mapping, post-fire aerial photos, and post-fire stand examinations taken by field crews during October and November, 1988.

There are 59,740 acres within the fire boundary of which 40,546 acres (68 percent) are burned and 19,194 acres (32 percent) are not burned. Of the burned acres, there are 20,981 acres (52 percent) timbered, and 19,565 acres (48 percent) non-timbered. Of the non-burned acres, there are 1,602 acres (8 percent) timbered, and 17,592 acres (92 percent) non-timbered. (For a complete breakdown of the burn acres and timber volume by land ownership, see Appendix J).

Plants respond to disturbance in any of four categories that are not mutually exclusive. They succumb, resist, sprout, or reproduce. Even plants that are mortally injured can and often do produce one last seed crop.

Grand fir, a climax species that gradually dominates undisturbed sites, is an example of a tree species with thin bark that is often killed by low-intensity fire. Its recovery depends on seed from nearby unburned islands. Decades to centuries may be required for these thin-barked, climax species to re-establish. Douglas-fir and ponderosa pine are examples of species that, with their thick, insulating bark and bud scales, often survive fire without damage or with less than mortal damage.

Willow, spiraea, ninebark, gooseberries, snowberry, and twinflower are examples of species that sprout. Sprouting, a common method of survival and recovery, takes advantage of existing root systems and assures the survival of an adapted genetic strain.

The mosaic of fire intensities, combined with unburned areas, left an array of vegetative compositions. These communities will develop following the normal stages of forest succession that occur after major disturbances.

Figure III-20

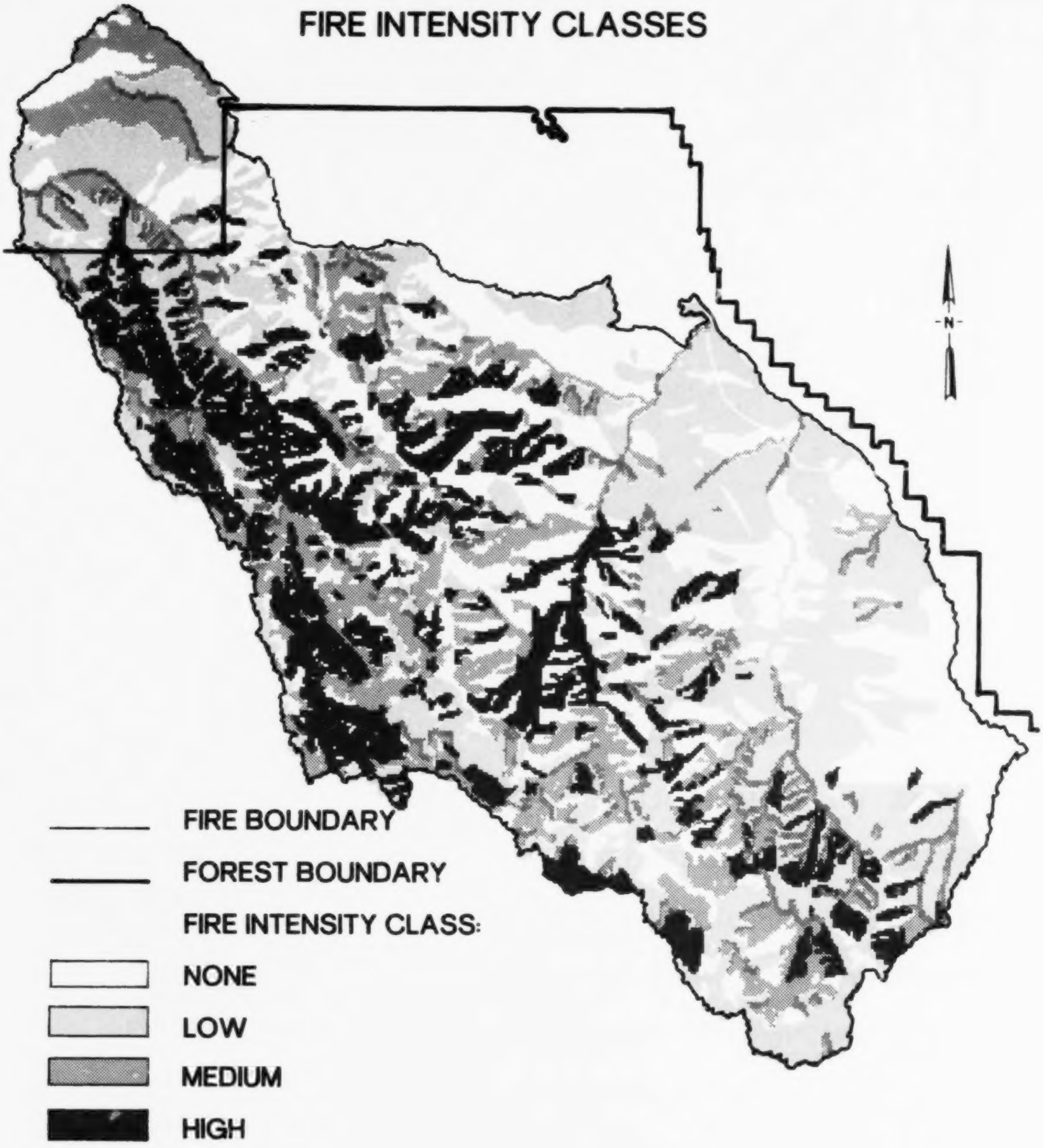
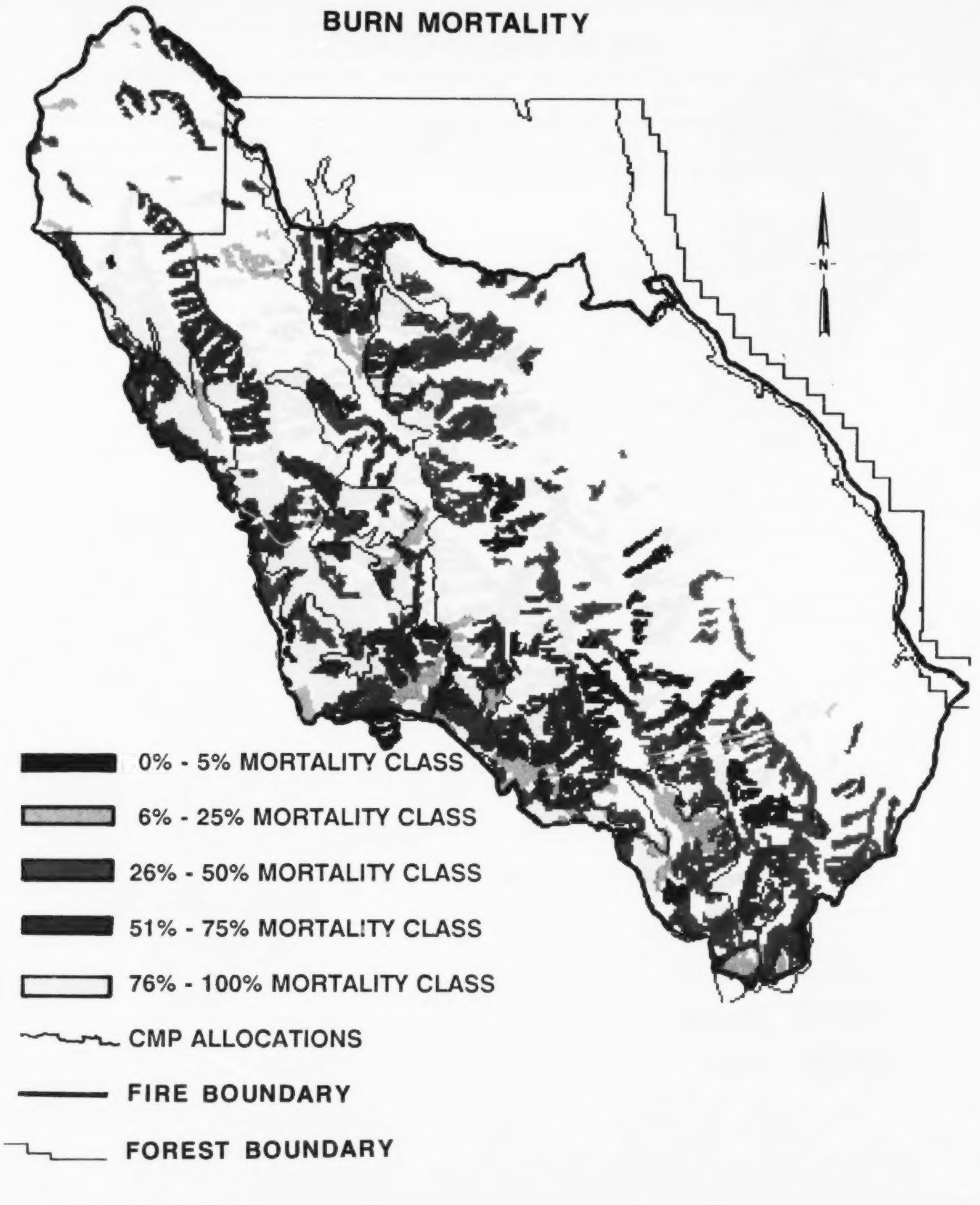

FIRE INTENSITY CLASSES
N
FIRE BOUNDARY
FOREST BOUNDARY
FIRE INTENSITY CLASS:
NONE
LOW
MEDIUM
HIGH

FIGURE III-21



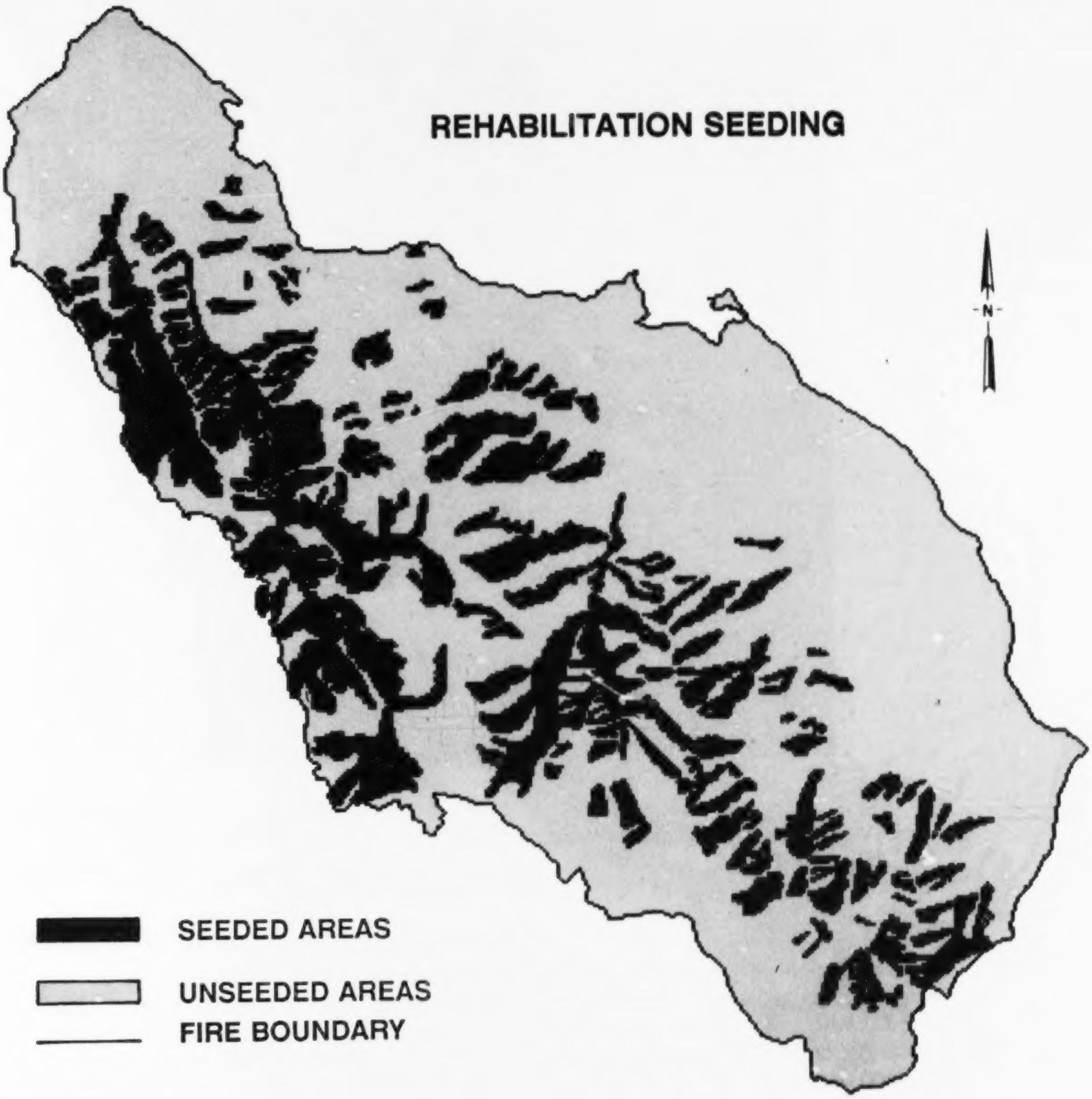
BURN MORTALITY

N
0% - 5% MORTALITY CLASS
6% - 25% MORTALITY CLASS
26% - 50% MORTALITY CLASS
51% - 75% MORTALITY CLASS
76% - 100% MORTALITY CLASS
CMP ALLOCATIONS
FIRE BOUNDARY
FOREST BOUNDARY

Vegetative patterns include steep timbered stringers lying in many intricate branching ravines.

Additional plant species were introduced by grass seeding medium-intensity burned areas, high-intensity burned areas, and firelines to reduce post-fire erosion. A seed mixture of winter wheat (31 percent), Potomac orchard grass (23 percent), white Dutch clover (15 percent), yellow sweet clover (15 percent), hard fescue (8 percent), and small burnett (8 percent) was used on the DR/TM and Forage areas, and a seed mixture of mountain brome (22 percent), sheep fescue (11 percent), winter wheat (56 percent), and yellow sweet clover (11 percent) was used on the DR/NV areas. The DR/TM and Forage mix was formulated with a relatively high percentage of annual or short-lived species to reduce long-term competition with natural or planted conifer regeneration. The DR/NV mix was formulated with a high percentage of annual, short-lived species, or native species to meet the long-term goals of native vegetation in this allocation (see Rehabilitation Grass Seeding Map, Figure III-22 for the areas seeded with grass for erosion control purposes).

FIGURE III-22



REHABILITATION SEEDING

N
SEEDED AREAS
UNSEEDED AREAS
FIRE BOUNDARY

With fall rains, there was a slight green-up of native grasses within burn areas during the Fall of 1988, particularly on the low-intensity burn areas in the natural grasslands. Likewise, there was also germination response by some of the aerially sown erosion control grass seed.

Timber Management

Commercial forest land (CFL) occupies 40 percent of the Tepee Butte Fire area. The other 60 percent is made up of grasslands, meadows, hardwood shrubs, rocky areas, non-commercial forest land, and forested lands unsuitable for timber production, usually because of difficulty in re-establishing trees after harvest. The CFL is moderately productive (see Appendix J).

According to the Hells Canyon NRA Act (PL 94-199), timber management is permitted within the provisions of the legislation. Timber may be harvested only by selective cutting . Within the CMP, selective cutting has been interpreted to mean only individual trees or small groups of trees covering up to two acres in size can be harvested for timber management purposes. Larger openings may be created for other resource objectives. However, such site-specific proposals are to be considered discreetly on a case-by-case basis through the NEPA process. In 1984, a decision was made to permit shelterwood cutting as a silvicultural treatment.

The DR/TM allocation, including those portions within the project area, has been lightly salvage logged by tractor in the past. (See Appendix J for a logging history.) Timber in the DR/TM allocation is part of the Wallowa-Whitman Working Circle timber base.

Salvage, in excess of the annual green timber harvest amount (5-9 MMBF), is consistent with and in conformance with the Hells Canyon NRA Act and NFMA so long as it furthers the purposes of the Hells Canyon NRA Act by maintaining or enhancing recreational values and public enjoyment.

The reduction of standing timber volume and growing stock, as a result of the fire and salvage, will be evident in future timber inventories and will be considered in the calculations of the allowable sale quantity in the next 10
year update of the Forest Plan.

TRANSPORTATION SYSTEM

Ninety-eight miles of maintained open roads lie within the project area. An additional 16 miles of roads not maintained for public travel, including abandoned jeep trails and roads used but not maintained by any agency, are also present. Some roads have been closed and seeded to repair resource damage.

Most early roads were built for access to ranches, homesteads, mines, and later for harvesting timber. Forest roads within the project area are low standard, gravel, or dirt-surfaced and designated for low speed (up to 25 mph) travel. All are single lane, some with turnouts. Many have steep grades, sharp switchbacks, and rough surfaces.

The existing Forest road system meets the standards required by the area resource objectives. See Working Paper entitled: *Tepee Butte Recovery Project Transportation*

System Analysis on file at the Wallowa Valley Ranger District, North End Engineering Zone for more information on transportation facilities in the project area.

The project area is accessed from the Enterprise/Joseph area via the following roads:

> Forest Roads - - - Forest Service Roads 46, 4620,4625, 4670, 4680, and 4690. These are the arterial and collector roads. Approximately 79 miles of local roads are within the project area.
>
> County Roads - - - Wallowa County roads 699, 765, and 798.
>
> State Highway - - Highway 3 and Highway 82.

The current appraisal point for timber in this area is to the community of Joseph, Oregon, via a combination of the above roads. A second appraisal point to Lewiston, Idaho, would exist if improvements were made to Wallowa County Road 699.

The Hells Canyon NRA CMP allows road construction if it is needed for timber harvest; however, it emphasizes non-roaded timber harvest methods.

The Chesnimnus cooperative road closure, between the Forest Service and Oregon Department of Fish and Wildlife, is in effect annually from three days prior to rifle elk hunting season until the end of antlerless elk hunting season (currently 24 days).

The objective of this closure is to:

1. Make additional habitat available where big game can easily find rest, shelter, and temporary escape from otherwise mobile hunters, thereby reducing stress and helping to ensure that the animals survive the season in better physical condition.

2. Provide additional area for a primarily foot and/or horseback oriented hunting experience.

3. Protect fragile soils from eroding, both on and adjacent to existing roads and trails; maintain existing soil rehabilitation measures.

Trails are addressed in Recreation.

RAPID TIMBER RECOVERY

Wildfire kills many trees outright and severely damages others predisposing them to insects, diseases, and wind impacts that can ultimately cause their death. The first two years following a fire is critical for severely fire-damaged trees, and it is during this period when further mortality is most likely to occur.

Timber volume losses resulting from direct causes, i.e., physical consumption of wood and charring, are generally quite small when green timber stands are involved.

Immediately following a fire, most fire-killed and severely fire-damaged trees are merchantable with only minor needs for volume defect deductions. Immediate post-fire salvage operations maximize recovery of both volume and value of the merchantable material.

Post-fire inventories made during October and November of 1988 showed the following volume estimates of fire-killed and severely damaged timber within the burn area. (see Figure III-23)

Figure III-23 Volume Estimated for Fire-Killed and Severely Damaged Trees

	Fire-killed Trees Gross Vol. (MMBF)	Severely Damaged Trees Gross Volume (MMBF)	Total Gross* Volume (MMBF)
Private Land	7.00	0.50	7.50
BLM Land	0.26	0.04	0.30
Wallowa Valley Dist.	0.10	0.30	0.40
Hells Canyon NRA			
DR/NV	84.00	12.30	96.30
Forage	61.80	4.30	66.10
DR/TM	53.00	12.10	65.10
NRA Subtotals	198.80	28.70	227.50
TOTALS	206.16	29.54	*235.70

*This gross volume total excludes dead trees that existed prior to the fire.

As time passes, deterioration of sawtimber volume and value occurs in fire-killed trees as a result of the combined activity of insects, fungi, and weathering processes. (For more information on timber deterioration processes, see Appendix A).

With completion of the Tepee Butte Fire Recovery Final EIS and salvage sale award dates projected for summer 1989, approximately one year will have passed since the Tepee Fire. This time period is too short for wood decay to be a problem, but insect activity and damage is expected to begin about late April or early May 1989. Also, weathering processes which create cracks and checks in the wood of smaller trees and tops of larger trees will be occurring during the 1-year lapse period and thereafter.

Initially, the primary concern with bark beetle attack is the blue stain fungus that is introduced under the tree's bark and is then available to stain the sapwood. Blue stain causes a considerable loss in lumber value, particularly in ponderosa and lodgepole pines. Based on the estimated midpoint period of salvage operations, the pine lumber will be devalued by approximately $150 per thousand board feet (see Appendix A).

With increased checking and cracking of wood in the hot, dry summer weather, the estimated volume loss, based on the midpoint averages for the salvage operation period, will consist of most fire-killed trees under 12 inches dbh and the top 16-foot cruise log of trees under 25 inches dbh. The combined loss of these two sources totals 29 percent of the volume of the fire-killed trees.

Poor access due to lack of roads can be a factor in delaying rapid timber recovery. In the case of the Tepee Butte Fire Area, the steeper canyons of the Dispersed Recreation/ Natural Vegetation and Forage allocations have only very minor amounts of roads in a small portion of their areas. On the other hand, the gentler plateaus of the Dispersed Recreation/Timber Management allocation are sufficiently roaded to prevent delays to salvage operations. The problem of poor access in unroaded areas can be relieved by substituting the helicopter logging system. This system, however, is generally marginal in economic efficiency unless large timber is available and some of it is species of higher value.

Based on the tree species and tree-size classes present in the fire area, salvage is economically feasible the first two years after the fire. Volume and value continues to decrease during this period. Beyond two years, sufficient volume and value to sustain an economically viable salvage operation would be unlikely. Deterioration-resistant species and large sized trees could retain some merchantable portion for 3-5 years. However, these trees may not support overall salvage operation efficiency because of location and dispersment.

SOCIAL AND ECONOMIC ENVIRONMENT

This section discusses the social and economic setting which would be affected by fire recovery project decisions. The management of resources and environmental conditions in the project area can affect the social and economic well-being of people living nearby and those using the forest. Activities, or lack of activities, in the project area will influence Wallowa, Baker, and Union Counties in Oregon. Figure III-24 represents the population trends in these counties. These data show relatively stable population levels over time, in contrast to the steady growth of more urban areas.

Figure III-24 Area Populations.

County	1930	1940	1950	1960	1970	1980 2/	1987 3/
Baker	16,754	18,297	16,175	17,295	14,919	16,127	15,300
Union	17,492	17,399	17,962	18,180	19,377	23,935	23,300
Wallowa	7,814	7,623	7,264	7,102	6,247	7,269	7,150
Tri-County	42,060	43,319	41,101	42,577	40,543	47,331	45,750

1/ All columns except 1980 and 1987: (Mackey 1978)
2/ Preliminary census figures.
3/ 1987 figures from "Labor Trend," State of Oregon Employment Division, Department of Human Resources, Nov. 10, 1988 issue.

The total population of this tri-county area has generally increased over the past 50 years. Baker and Wallowa Counties, however, have experienced periodic decreases, while Union County has exhibited the most dramatic increase, particularly in past 15 years. Migration figures (Pekar 1981) indicate that over a 30-year period (1940-1970) the area's net migration exceeded the natural increases leaving the area with a negative net change. This Tri-County area has only a 1.7 percent minority population (Pekar 1981).

Social Environment

A measure of social cohesion, shared values and goals, and a spirit of cooperation exists in both the communities and the area as a whole. Common to much of the area is an outdoor, natural resource-oriented lifestyle as seen by employment in the timber products industry and agriculture, and an enthusiasm for recreation activities such as hunting, fishing, and whitewater boating. This sharing of values is due in part to the community's rural environment. Boise, Idaho; Portland, Oregon; and Tri-Cities (Pasco, Richland, and Kennewick), Washington are the closest large population centers to the project area. At 190 miles, Tri-Cities is the closest.

Economy

Employment in the tri-county area is dominated by the government sector (Figure III-25). This sector includes such diverse employers as libraries, schools (including Eastern Oregon State College), police, and the Forest Service. Following the government in employed persons is retail trade in Baker and Union Counties and agriculture in Wallowa County. Wood processing is in third (Union), fourth (Wallowa) and fifth (Baker) places when considering percent of total employment in each county; however, it ranks second and third when considering percent of total payrolls for each industry (Figure III-26). This is because wages paid in both the government and wood processing sectors are above the overall average wage for the Tri-County area (Pekar 1981).

Figure III-25. Employment by industrial sector as a percent of total employment for the Tri-County area of influence (Source: IMPLAN 1982 data base, see Alward 1987).

	County					
	Baker		Union		Wallowa	
Rank	Sector	%	Sector	%	Sector	%
1	Government	28	Government	21	Government	31
2	Service	23	Construction	19	Agriculture	20
3	Trade	18	Service	19	Service	14
4	Agriculture	10	Wood Proc.	13	Trade	14
5	Other Manuf.	7	Trade	12	Wood Proc.	10
6	Wood Proc.	5	Other Manuf.	8	Other Manuf.	5
7	Financial	4	Agriculture	7	Financial	3
8	Construction	3	Financial	1	Construction	3
9	Mining	2	Mining	<1		
Total		100		100*		100

* Percents sum to 100 without mining.

Figure III-26. Employee compensation to industrial sector as a percent of total employee compensation for the Tri-County area of influence (Source: IMPLAN 1982 data base, see Alward 1987).

	County					
	Baker		Union		Wallowa	
Rank	Sector	%	Sector	%	Sector	%
1	Government	37	Construction	38	Government	37
2	Service	16	Wood Proc.	17	Wood Proc.	23
3	Other Manuf.	11	Government	17	Service	11
4	Trade	11	Service	11	Trade	9
5	Wood Proc.	10	Other Manuf.	10	Other Manuf.	7
6	Financial	5	Trade	5	Agriculture	6
7	Agriculture	4	Financial	1	Financial	4
8	Mining	3	Agriculture	1	Construction	3
9	Construction	3	Mining	<1		
Total		100		100*		100

* Percents sum to 100 without mining.

Natural resources are central to the northeastern Oregon economy. The northwest wood products industry continues to maintain its employment gains of 1986 and 1987 despite a leveling off in domestic demand. However, unemployment rates continue to be high, ranging from 10.8 percent in Union County to 14.9 percent in Wallowa County early in 1988 (State of Oregon 1988). Natural resources are also important to tourism and recreational use of the Hells Canyon NRA. This is seen in Wallowa County where trade and service sectors combine to account for 20 percent of the counties' payrolls.

County Revenues

The significance of the Wallowa-Whitman National Forest to the local economy extends beyond logs delivered to local mills. Federal revenues shared with local governments are of great importance locally. Twenty-five percent of timber sale and other receipts from National Forest land is returned to counties for school support and road construction. Revenues depend on the amount and quality of timber sold. Figure III-27 displays the 25 percent fund amounts that Baker, Union, and Wallowa Counties have received over the past 5 years.

Figure III-27 Revenues (dollars) received by Wallowa, Union, and Baker Counties from Wallowa-Whitman National Forest timber sales.

Fiscal Year	Wallowa	Union	Baker
1988	1,254,956	718,062	841,193
1987	886,245	761,935	897,580
1986	1,089,258	757,447	890,251
1985	1,011,171	682,856	799,993
1984	1,020,043	502,751	586,313

Current and Future Demands for Forest Outputs

Management activities and resource conditions in the project area influence how the Wallowa-Whitman National Forest provides for current and future demands.

Timber--The importance of timber in the project area is linked with the overall local timber supply. Timber from the north half of the Wallowa-Whitman National Forest is used primarily in three market areas. The Enterprise area (Wallowa County) utilizes timber from the Hells Canyon NRA and the Wallowa Valley and Eagle Cap Ranger Districts as well as from private lands and BLM lands within the county. The La Grande market area (Union County) receives timber from La Grande, Wallowa Valley, and Baker Ranger Districts. The Baker market area (Baker County) receives timber from Baker, Unity, and Pine Ranger Districts. The La Grande and Baker market areas both receive timber from private, BLM, and other public lands.

Twenty-five percent of National Forest timber receipts is returned to local counties for school support and road construction.

Most timber to be salvage harvested in the project area, if any, would probably be milled in the Enterprise and La Grande market areas. Some timber in the northeast corner of the project area could be used by mills in the Lewiston, Idaho area, some could also be used by mills in the Baker area.

Harvests on private lands in northeast Oregon have been low and are not expected to increase dramatically during the next 10 years. As a result, demand for timber from the Wallowa-Whitman National Forest in all three market areas should remain high for the foreseeable future.

The Tepee Butte Fire Recovery Project is planned in accordance with the Hells Canyon NRA CMP approved May 28, 1981. This plan established the level of outputs and returns to be derived from the area. It specifically addressed the allocation of lands to specific management categories. It further specifies the type of timber harvest methods and standards of road construction which can be performed.

The amount of timber damaged on lands allocated as Dispersed Recreation/Timber Management may affect the future Allowable Sale Quantity (ASQ) which may also be affected by how much of this damaged volume is eventually salvaged. The reduction of standing timber volume and growing stock, as a result of the fire and salvage, will be evident in future timber inventories and will be considered in the calculations of the ASQ in the next update of the Forest Plan.

On National Forest lands within the Hells Canyon NRA an estimated 31 percent (52.5 million board feet (MMBF)) of timber killed by the fire is on land classified as DR/TM. The remaining 118.2 MMBF is on land classified as Dispersed Recreation/Native Vegetation and Forage. The DR/NV or Forage classifications do not allow for regulated timber harvest under the CMP.

Fire-killed timber that is not included in the ASQ calculation may be harvested to achieve other resource objectives. Mortality volume is typically sold in addition to the regular sale program, but may be included in the ASQ. Any volume salvaged and sold in addition the regular sale program would have a short-term economic effect, but would not influence the Forest's ability to produce timber in the future.

Fish Habitat, Water Quality, and Soil Productivity--Three streams within the fire recovery project area can be expected to be affected: Cottonwood, Cook, and Cherry Creeks. Cottonwood Creek is an anadromous fish stream, and thus, economic values are easily assigned. For Cook and Cherry Creeks, direct economic values cannot be assigned. These two streams may contain redband trout--classified by the U.S. Fish and Wildlife Service as a Threatened and Endangered Category 2 species (needing further study) and on the Forest Service Region 6 Sensitive Fish List (Feb. 1987). Sport fishing in Cook and Cherry Creeks is probably quite limited. The inherent value of these redband trout populations is in their genetic uniqueness.

Cottonwood Creek: Potential steelhead smolt production capacity for the stream segments within the recovery project is 9,275 smolts. Available spawning and rearing habitat is 67,444 square meters and available rearing-only habitat is an additional 63,276 square meters (Oregon Department of Fish and Wildlife, 1966). Using a value of $106 per adult fish (value is for adult steelhead in the next closest sub-basin to the Grande Ronde), the annual net worth of adult steelhead production is $14,734.

Wildlife and Recreation--Wildlife habitat concerns include maintaining viable habitat for old-growth-dependent species, dead and decadent tree habitat, and suitable areas for big game. Fire has markedly altered wildlife habitat in the project area (see Chapter III, Wildlife Habitat).

Each year, the Oregon Department of Fish and Wildlife issues 1,500 bull elk and 350 cow elk tags for the area. Deer and elk hunters contribute an annual average of 44,500 recreation visitor days (RVD) in the project area.

Because of its rugged topography and remoteness, the current recreation use of the area is relatively minor compared to the rest of the Forest. It is estimated to be 52,800 RVDs per year. The number of people visiting the area is not expected to increase dramatically. Roaded areas are expected to show a slight increase in use due to the novelty of viewing the fire area, but this would probably not persist beyond the first few seasons. The project area provides a natural scenic setting for people viewing Hells Canyon from several vistas.

As with wildlife, the effects of alternatives on recreational opportunities are discussed in qualitative terms except for big game hunting. Monetary values were not estimated because differences among alternatives are expected to be short-term. The Oregon Department of Fish and Wildlife will restrict both deer and elk hunting for the forseeable future due to the loss of cover caused by the fire. A monetary value can be placed on this loss and will be included in the economic analysis.

RESOURCES NOT DIRECTLY RELATED TO THE ISSUES

INSECTS AND DISEASES

Insects

When catastrophic events such as fires and windstorms occur, populations of bark beetles and wood boring insects, with their parasites and predators, are drawn in from undamaged stands to rapidly exploit the favorable new condition. This influx of insects comes from only a few miles around the fire area.

Insects usually colonize trees severely damaged by fire. Trees that survive fire are especially attractive to bark beetles. Although trees killed by the fire are not often colonized by bark beetles, they may still be used by some woodborers and woodwasps which feed mostly in the wood. Trees on the edge of the Tepee Butte Fire and within the green islands of trees that escaped fire damage are at highest risk from bark beetles and certain woodborers.

Bark beetles are not expected to create an epidemic by multiplying in the project area and attacking adjacent or surrounding undamaged stands. A full discussion of the factors considered and the rationale leading to this conclusion is included in Appendix E.

Douglas-fir and grand fir are the major species component of the project area and surrounding areas; therefore, emphasis will be on the insects associated with these species. Bark beetles and wood boring beetles are the two most destructive insects associated with fires because they breed in recent dead or weakened trees and in logging debris and slash.

The flatheaded fir borer is often found in association with beetles that prefer Douglas-fir and aids these bark beetles in killing fire-scorched trees and loosening the bark of fire-killed trees. This borer usually invades dead or dying trees but can be very destructive to living trees as well.

Pre-Fire Conditions--Present mortality levels from bark beetles in these stands are due to the protracted drought of the past several years and are not related to this fire or previous fires. This conclusion is supported by annual surveys conducted by the Forest Service showing that bark beetles are recently on the increase region-wide.

Post-Fire Conditions--Bark beetles would disperse from the fire area once trees associated with it are no longer suitable; tree mortality would then be expected to return to normal levels.

Because only a small component of pine exists in the fire area, there would not likely be a large population of engraver beetles; therefore, this insect species probably does not pose a hazard to undamaged trees. A minor amount of engraver-caused mortality of fire-injured pines, however, will probably occur during the next 2 or 3 years in the fire area.

A host of other woodboring beetles and woodboring wasps attack fire-killed trees and are likely to be encountered in the burn area. Although none are tree killers, after a few years, their activity along with that of decay fungi can seriously degrade wood. See Appendix E for a list of woodboring insects most likely to occur on the project area.

Diseases

Tree diseases are a normal part of our forest ecosystems. Disease-caused mortality is viewed as loss because we have put a value on living, healthy trees as a resource. Types of diseases and the degree of disease impact will change based on plant community, stand history, and successional status. Human-caused changes to the natural conditions of our forests, including fire exclusion and harvest methods, has generally resulted in an increase in tree diseases and disease-caused damage.

Fire can generally be viewed as beneficial in the long-term because it removes shade-tolerant, disease-susceptible species and reverts the stand to a higher component of seral species. The potential for disease-caused losses in the long-term is much greater in stands that have not been exposed to fire for a long time or have not been silviculturally treated. Some short-term adverse impacts may occur; trees that are weakened by fire may be attacked by pests that prefer stressed hosts. Silvicultural strategies for stands affected by fire need to be carefully selected and ramifications of disease-caused impact must be considered.

Root diseases are common pests of mixed-conifer stands, especially stands that have been managed through partial cutting methods. Root diseases are particularly damaging, because infected roots and stumps will infect subsequent generations of trees. Conditions for successful root disease colonization are believed to exist most of the year. Even trees cut during winter may be colonized in the spring following snow melt and thawing. Conditions in mid-July through August may be less-than-favorable due to high temperatures and low humidity.

Two of the more common root diseases which affect true firs in mixed conifer stands are *Fomes annosus* and *Armillaria ostoyae*. Resulting damage includes wood loss through decay and mortality. Ponderosa pine and Douglas-fir stumps may become infected, but on most sites do not result in spread to adjacent trees. Where Armillaria is virulent, all associated species except larch and lodgepole pine may be extensively damaged.

Dwarf mistletoe, a parasitic plant that requires a living host, obtains nutrients and water from the host. This causes the tree to produce deformities, such as swellings and "brooms," reducing the vigor of the tree. Most conifers are susceptible to their own species-specific mistletoe parasite. Individual infected trees surviving fire can serve as sources of infection. Lightly- to moderately-infected trees can be retained for seed if they are removed once regeneration has occurred.

Indian paint fungus causes a red-brown, stringy, heart rot that can extensively damage stands. It causes approximately 80 percent of the decay in old growth grand fir in the Blue Mountains. Cull rates can exceed 40 percent of gross board foot volume on a stand basis.

AIR QUALITY

Air quality was not raised as an issue, but it is tied very closely to fuel management, visual quality, and management concern about using fire to protect and enhance Forest resources. Outside the Hells Canyon Wilderness area, the NRA is identified as Class II under the 1963 Clean Air Act, allowing moderate levels of decline in air quality.

Prescribed burning for site preparation and fuel management in the project area will be subject to air quality standards set by the State Air Resources Control Board. Any proposed project activities will meet these standards.

CULTURAL RESOURCES

Pre-fire Conditions--Cultural resources are the physical evidence of past human activities and include artifacts, dwelling sites, use areas, ceremonial sites, travel routes, and any other human items left or marks made on the land. This tangible record, in combination with historic documents, oral history, ethnography, and ecologic data, is interpreted by archaeologists and historians when reconstructing the series of prehistoric and historic events leading to our modern era.

Hells Canyon is rich in cultural resources; signs of earlier life abound and provide visitors a stimulating encounter.

Prehistoric occupation of the general region spans at least 8,000 years. Cultural resource sites within the project area may be this old or older. Prehistoric sites recorded in the project area have been dated back 4,500 years. These sites reflect a pattern common to the region, known as a seasonal subsistence round, wherein relatively large winter villages are located on major tributaries near the main river, and smaller sites used during the spring, summer, and fall are located in upland areas.

Seasonal activities such as root gathering, berry picking, hunting, quarrying of stone tool material, and gathering of other forest products created upland archaeological sites. Both long- and short-term habitation sites are located near water sources on fairly level ground, whereas other use areas depend on the location of the resource being exploited.

Cultural resources are the physical evidence of past human activities.

Euro-American explorers encountered Nez Perce Indians when they first entered the area. Anthropologists believe the prehistoric inhabitants of the area are ancestral to these Nez Perce.

Exploration, fur trading, and mineral prospecting, followed by sporadic mining and homesteading, were the initial historic uses of the area. Fur trappers probably visited the area by the early 1800s, and by 1820 numerous attempts to navigate the Snake River to its confluence with the Columbia River had been made.

The first documented entry into what is now Wallowa County by non-Indians was made by Captain Benjamin Bonneville and his party in 1834. Idaho's well known pioneer missionary, Henry Harmon Spaulding, was the next recorded visitor to the area in 1839.

Stock raising began in the region about 1867. In 1880, Robert Downey sought winter range and built a cabin in the gulch which bears his name. Downey Gulch lies in the northeastern part of the project area. In 1894, Jay Dobbin first drove sheep into the Wallowa-Imnaha area and later established the Cherry Creek Ranch.

A small scale "rush" of prospectors to the copper deposits at Eureka Bar began in the spring of 1899 when two local cattlemen, M.E. Barton and M.R. Hibbs, staked the first claims. By 1902, corporations partially backed by eastern capital had become involved in the development of mines surrounding the mouth of the Imnaha River. The Eureka Mining Road was constructed in 1903 and used to carry supplies to the mine on Eureka Creek until the mine closed in 1906.

The Forest Service also contributed to the culture and history of the area through its land stewardship role which began soon after the turn of the century.

Historic dwellings provide valuable information for reconstructing events leading to our modern era.

Post-Fire--Archaeologists recently completed an inventory of the cultural resources within the project area. The ensuing report was submitted to the Oregon State Historic Preservation Office (SHPO) for review, in compliance with Federal statutes, regulations, and Forest guidelines (see Appendix I). Seventy-eight known archaeological sites were inventoried following the fire to assess their condition. Twenty new sites were discovered. A 1978 inventory of the Snake River Corridor recorded an additional 69 sites, none of which were affected by the fire. Sites recorded include prehistoric villages, camps, rock cairns, rock shelters, and culturally scarred trees. Historic sites include ranches, cabins, dumps, mines, travel routes, and Forest Service structures. The Cherry Creek Ranch, Cold Spring Cow Camp, and some of the culturally scarred trees were destroyed by the fire, but the other cultural resource sites were relatively unscathed.

ENERGY

Other than wood fiber, no potentially marketable energy sources exist in the project area. Woodcutting by the public for domestic use is of minor importance within the fire area. The DR/TM allocation is the only area where woodcutting is permitted. Due to the relatively long distance from a metropolitan area the amount of fuelwood removed is insignificant.

Further hydropower development on the Snake River has been precluded by the Wild and Scenic Rivers Act. No hydroelectic projects exist in the fire area on the major creeks (Cook, Cherry, Cottonwood), nor have any proposals for such projects been made.

FIRE AND FUELS MANAGEMENT

Pre-Fire Conditions--The history of fire occurrence obtained from most recent Forest Service fire planning records (1979-1988) indicates a total of 25 lightning-caused fires within the Tepee Butte burn area. These 25 fires are classified by size as follows:

Class	Size Range (Acres)	Number of Fires
A	less than 0.25	7
B	0.26-9	12
C	10-99	6

Fifteen of the 25 fires occurred during the unseasonably dry fire season of 1986. The 60,000-acre Tepee Butte Fire is termed a "project fire" because extraordinary methods and staffing levels were needed for control.

Woody material is an integral part of the total ecosystem. Most slash abatement measures do not remove this essential element entirely. Instead treatments manipulate or rearrange the slash to reduce fire hazard while still retaining some material for soil-building and other values.

The fuel loads throughout the planning area varied according to the occurrence of timber harvest activities, and whether the land supported thick vegetation or was sparsely vegetated and rocky. Rocky areas had the least vegetation and therefore acted as natural fuelbreaks.

Fuel loadings vary between dense thickets and areas that are sparsely vegetated and rocky.

Post-Fire Conditions--After the Tepee Butte Fire, the existing fuel loadings, fuel profiles, and stand structures throughout the entire burned area had changed. The fire destroyed complete stands of timber, several ranging in size from 300 to 400 acres. In other areas, low-intensity ground fires crept around burning mostly surface fuel with some occasional torching out of individual trees.

The remaining unburned or partially burned areas within the fire's perimeter are not considered a serious hazard. In most cases, only under severe conditions involving high temperatures, low humidities, and high winds do the remaining fuels pose fire hazards. Overall, the fire/fuel situation within the Tepee Butte burn area is not creating a high or serious fire hazard at this time. Fuel loading is expected to increase over time as standing material falls to the ground.

INDIAN RIGHTS

Northeastern Oregon was the home of several Indian Tribes prior to Euro-American arrival. By the mid-1800s, these Indians were gradually being displaced from their traditional hunting, fishing, gathering, dwelling, and ceremonial grounds. Since the mid-1850s various treaties, executive orders, statutes, court decisions, and commission adjudications have granted certain rights and privileges to American Indian citizens. The Tepee Butte Fire Recovery Project, contained within the Hells Canyon NRA, lies within the area covered in the "Treaty with the Nez Perces, 1855." The following Indian rights, contained in Article 3, continue to exist:

> The exclusive right of taking fish in all the streams where running through or bordering said reservation is further secured to said Indians; as also the right of taking fish at all the usual and accustomed places in common with citizens of the Territory; and of erecting temporary buildings for curing, together with the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land.

The "Treaty with the Nez Perces, 1863," substantially reduced the amount of land reserved by the 1855 treaty, effectively excluding the land which now lies in the project area. The eight-fold reduction in the size of the 1855 reservation was due to discovery of gold in the 1860s along the Clearwater River. Much of this land was subsequently homesteaded.

A 1977 map titled "Treaty Boundaries; Portland Area Jurisdiction" issued by the Bureau of Indian Affairs, confirms these Nez Perce Treaty boundaries (12 Stat. 957) and indicates no other treaty rights by other Indian tribes over the area within the project. Those provisions of the 1855 treaty which were not specifically nullified in 1863, such as the part of Article 3 cited above, are still in effect.

The American Indians Religious Freedom Act of 1978 (AIRFA; PL 95-341) specifically protects and preserves American Indians' right of freedom to believe, express, and exercise their traditional religions. This includes access to sites and use and possession of sacred objects.

In a continuation of the ongoing consultation process between the Forest Service and local tribes, the Nez Perce, who traditionally used this area, were consulted about this issue. The Nez Perce Tribal Executive Committee was requested to identify any sacred sites within the Tepee Butte Fire Recovery Project area so that these sites can be protected in compliance with AIRFA.

In 1980, the Federal court held that a treaty right to fish is meaningless if most of the fish are destroyed by a hostile environment and that others have the obligation to refrain from degrading habitat to the extent that tribes would be deprived of moderate living needs. The court further held that environmental conditions essential to anadromous fish runs include access and an adequate supply of good quality water (*United States v. Washington*, Phase II, 506 F Supp. 187, W.D. Wash. 1980).

Detailed summaries of laws and decisions may be found at the Wallowa-Whitman National Forest Supervisor's Office in Baker.

Two meetings were held between representatives of the Columbia River Inter-tribal Fish Commission and the USDA Forest Service to record the concerns and answer questions of Commission members about fisheries and water quality. These meetings held on January 5, 1989 and March 31, 1989 were attended by representatives from the Confederated Tribes of the Umatilla Reservation and the Nez Perce Tribe. In the first meeting, the Commission members expressed willingness to act as reviewers throughout the development of the DEIS. In the second meeting, there was a more technical discussion of impacts of alternative recovery strategies on water quality and fisheries.

MINERALS

For a discussion of history and known mineral deposits, refer to the CMP, page 37.

The operation of existing valid mineral rights is permitted within both the Hells Canyon NRA and its wilderness, but new mineral entry is prohibited. Any mining activity, according to Public Law 94-199, must be "compatible with the provisions of this Act."

A review of the Bureau of Land Management's Mining Claim Records for 1987 lists no active claims within the project area. No mining-related structures are known to have been affected by the fire.

PALEONTOLOGY

The rocks in the area are mostly igneous basalts and marine sedimentaries which usually do not contain vertebrate fossils. As of August 1986, invertebrate fossils, unless declared a unique site meriting special consideration, are no longer protected (36 CFR 261).

The Federal Register (Fed. Reg., August 26, 1986) lists paleontological (fossil) sites known to exist as of 1978, none of which are located within the project limits. A search of the recent literature and consultation with geologists familiar with the area confirmed the project area's low potential for fossil remains.

If paleontological sites are discovered during any phase of the project, they will be evaluated by a qualified specialist to determine conformance with the applicable statutes, regulations, and guidelines.

THREATENED, ENDANGERED, AND SENSITIVE SPECIES

ANIMALS

The Forest Service consulted with the U.S. Fish and Wildlife Service and the Oregon Department of Fish and Wildlife about listed and proposed Threatened and Endangered animal species that occur in the project area. The Forest Service Region 6 Endangered, Threatened, or Sensitive Species lists were also reviewed.

Endangered Species

AMERICAN PEREGRINE FALCON (*Falco peregrinus anatum*)--A number of peregrine falcon sightings have been recorded in and around the Tepee Butte Fire, some during the nesting season. An historic but now inactive aerie about 14 miles north of the fire area is within the maximum daily hunting range of peregrine falcons. A re-introduction (hack) site, from which two birds were successfully released in 1987 and four more in 1988, also lies in the vicinity of this aerie. Another hack site lies 20 miles east and south of the area, from which four birds were successfully released in 1987 and 4 more in 1988. Within the fire area, 18 rock formations may be suitable nesting sites for peregrine falcons. Currently, no known peregrine falcon nest sites are identified within the project area. Effects of the fire on habitat for this species are believed to be minor.

Threatened Species

Northern Bald Eagle (Haliaetus leucocephalus)--Bald eagles occur throughout the project area, particularly during non-nesting season. Most use is in the Snake River vicinity during winter. Significant use occurs particularly along the upland ridges when big game and livestock carcasses are available as a food source. No known nesting sites exist in this vicinity.

Category 2

Category 2 indicates a need for further information to confirm the appropriateness of proposing the taxon to the list of Endangered or Threatened Species.

Redband trout (Onchorynchus spp.)--Taxonomy of the subspecies is unclear. Although identification has not been verified, redband trout reportedly occur throughout the Cook Creek and Cherry Creek drainages. Post-fire judgment and consensus is that populations in these creeks survived the fire and should remain; however, increased water temperatures and sedimentation due to the effects of the fire will likely result in less favorable habitat conditions.

Swainson's Hawk (Buteo swainsonii)--The closest known nesting site of this species to the project area is 8 miles south of the fire boundary. Post-nesting dispersal and migration occurs over the Tepee Butte Fire area, and incidental hunting and feeding is also likely. The fire is expected to produce a short-term increase in the prey base for this species.

Ferruginous Hawk (Buteo regalis)--The closest known nesting site of this species is about 9 miles south of the fire boundary. Post-nesting dispersal and migration occur over and across this area. Hunting and feeding likely occur as the hawks pass through. The fire is expected to result in a short-term increase in the prey base for this species.

Western Yellow-billed Cuckoo (Coccyzus americanus)--Never a common species in the state, particularly in eastern Oregon, it has been recorded in heavy willow habitats along the Snake River, Columbia River, Willow Creek in Malheur County, and in La Grande in Union County. The species likely occurs in similar habitats within the fire area along the Snake River and/or in tributary side canyons. The fire has resulted in a short-term reduction in available habitat for this species; however, most riparian areas within the project area dominated by deciduous vegetation were lightly burned or unburned.

Preble's Shrew (Sorex preblei)--The species type locality for the Preble's shrew is along Sleds Creek 18 miles west and south of the fire. Its distribution was reconfirmed in 1974 and 1975 in that same area. Little work has been done with this species or its distribution. It is reasonable to expect its occurrence near streams at least above 3,500 feet elevation, in this project area. The fire has likely resulted in a short-term reduction in habitat for this species.

Spotted Bat (Euderma maculatum)--This species is widely distributed in Idaho; it has also been recorded in Wheeler and Harney Counties of Oregon and near Penticton, British Columbia. Spotted bats prefer rimrock/cliff habitat associated with open ponderosa pine ecotypes. This habitat is abundant within the project area, so although there is no record of the species in the project, it is possible the species could be present. The fire has killed or damaged some ponderosa pine; however, large pine trees near the rimrock/cliff sites were less likely damaged because the fire was less intense in these areas.

Townsend's Big-eared Bat (Plecotus townsendii)--An identified maternity site for this species exists about 1/2 mile east of the fire area. Based on distributional records, it is reasonable to assume that Townsend's big-eared bats use hibernacula and other grouping sites throughout this project area. Like the spotted bat, this species prefers habitats having cliffs and rims with caves. The fire likely affected the potential prey base for this species; however, it is not yet known if the change would impact potential bat populations.

Wolverine (Gulo gulo luteus)--Wolverines occur in Idaho and northeastern Oregon in low numbers. Their principal habitat is coniferous ecozones above 4,000 feet elevation. No recent sightings have been reported for the project area. If transient animals from other areas do occasionally traffic this area, they do not appear to stay. The fire has reduced the quality of available habitat for this species.

North American Lynx (Felis lynx canadensis)--The last lynx recorded in Wallowa County was killed in 1969 near the town of Imnaha. When lynx inhabited this general area, the project area was undoubtedly significant habitat. Presently, it is unlikely there are any resident animals or transients from a viable population in Idaho or elsewhere. The prey base for this species will likely increase following the fire.

Blue Mountains cryptochian (Cryptochia neosa)--This caddis fly is dependent on aquatic habitat of springs and streams. Although it is not known to exist in the project area, suitable habitat is available. The fire will result in increased stream temperatures and sedimentation, thus reducing the potential habitat for this species.

Sensitive Species

Lewis' Woodpecker (Melenerpes lewis)--This is a fairly common species along the Snake River, Cottonwood Creek and similar tributaries, particularly at lower elevations up to 4,000 feet. It is most typically associated with cottonwood habitats, although it also nests in ponderosa pine. The fire, which created an abundance of larger pine snags, was beneficial, at least in the short term. An increase in populations of Lewis' woodpeckers was observed at the Freezeout Fire that burned in 1974 approximately 25 miles south of the project area.

PLANTS

The Forest Service consulted with the U.S. Fish and Wildlife Service and the Oregon Department of Agriculture about listed and proposed Threatened, Endangered, and Sensitive plant species that occur on the project area. The USDA Forest Service Region 6 Sensitive Plant List (February 1988) was also reviewed. Following is a list of plants known to exist in or near the project area.

Endangered and Threatened Species

No endangered or threatened plant species, or their critical habitats, are known to exist on the project area.

Category 2 Species (1985 Federal Register Notice of Review)

Yellow Fleabane (Erigeron chrysopsidis brevifolius)--This subspecies is recorded as present in the area immediately south of the fire perimeter. The elevation at this point, and of the project area in general, is well below the elevation range for the subspecies, and therefore it is felt that the record is due to an error in identification.

Oregon State Status, Extinct

Minute Phacelia (Phacelia minutissima)--This species is listed as extinct in Oregon. However, it remains on the Regional Forester's Sensitive Species list. The only sighting for this plant was recorded in 1934; subsequent searches for this species in the area of its last sighting have been fruitless.

Oregon State Status, Endangered

Lace Fern (Chelanthes feel)--This species has been recorded within the vicinity of the fire and possibly occurs within the fire area where suitable habitat, such as moist, rocky outcroppings, exists. The probability of fire damage to this species is relatively low because of its habitat.

Oregon State Status, Threatened

Sierra Onion (Allium campanulatum)--There is one record of this species for the project area. The onion is associated with dry, rocky sites and xeric plant species including bluebunch wheatgrass and prickly pear cactus. The fire burned lightly through these vegetation types and would have had little impact on this species.

CHAPTER IV

ENVIRONMENTAL CONSEQUENCES

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CHAPTER IV

ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter discloses the direct, indirect, and cumulative environmental consequences of implementing the alternatives presented in Chapter II. It provides the scientific and analytic basis for the comparison of the alternatives in Chapter II. The various alternatives propose actions that would affect the physical, biological, economic, and social components of the human environment. The terms "effects," "impacts," and "consequences" are used interchangeably. They can be quantitative or qualitative, short-term or long-term in duration, adverse or beneficial, real or potential, tangible or intangible, significant or insignificant, unavoidable, irreversible or irretrievable, and can conflict with the actions of other agencies.

The effects resulting from each action are described in terms of their significance, magnitude, and duration. Combinations of effects occurring over time can produce cumulative effects. Wildfire and responsive recovery activities could be an example. In an area burned by wildfire, recovery efforts might include such projects as road construction, timber salvage, fuels treatment and reforestation. These activities, occurring in the same area over time could, under certain circumstances, be incremental and produce cumulative effects.

The assessment of effects assumes that implemented recovery projects will comply with policies and standards established in the CMP, NFMA, NEPA, Regional standards and guidelines and other policies, and Federal laws and National policies.

CONSEQUENCES RELATED TO MAJOR ISSUES

RECREATION RESOURCES

INTRODUCTION

The various alternatives propose actions that would affect the recreation resources environment. The environmental consequences of proposed actions are presented in four sections. The first section, **Important Interactions**, provides background for understanding the sections which follow.

The second section describes the specific effects of implementing each alternative. There are seven categories within this section. The first category, **Effects Common to All Alternatives**, discusses the general effects of the fire on recreation resources. The second category, **Effects Common to Alternatives G, H, and J**, discusses the general effects of the timber salvage operations. The third category, **Effects Specific to Alternative A**, discusses the effects of the No Action Alternative. The remaining four categories discuss specific recovery activities and their effects on recreation resources. They are: **Effects Specific to Alternative G, Effects Specific to Alternative H, Effects Specific to Alternative I, and Effects Specific to Alternative J**.

The third section presents a summary of the action alternatives. It points out specific advantages and disadvantages of management activities on recreation resources, and it includes some projected costs and benefits.

The final section describes the following categories of environmental consequences: Irreversible and Irretrievable Effects, Probable Unavoidable Adverse Effects, Short-term Use Versus Long-term Productivity, and Effects Unchanged by Alternatives.

Where more background or detailed information is desired, reviewers can consult the Recreation Resources portion of Chapter III, the Recreation Feature Prescriptions section of Appendix H, and the Resource Recovery maps for each alternative.

IMPORTANT INTERACTIONS

The NRA Act of 1975 provides direction for managers of the Hells Canyon NRA. The Act prescribes that a wide range of land uses and recreation opportunities should be provided within each NRA. The Comprehensive Management Plan (CMP) for the Hells Canyon NRA considers recreation the primary use of resources within each of the four resource allocations contained in the Tepee Butte project area. The Dispersed Recreation/Native Vegetation (DR/NV) direction emphasizes nonmotorized recreation opportunities. It favors natural succession of native vegetation and allows no timber management activities. Direction for management of Forage allocation areas ensures protection of old growth trees and allows timber management activities only when recreation, wildlife, or scenic values would be enhanced. The Dispersed Recreation/Timber Management (DR/TM) direction requires that timber management activities be conducted in such a way that ample opportunities for dispersed recreation are available. And finally, the Scenic River Corridor (SRC) allocation specifically directs that values for which the NRA was established be maintained or enhanced.

A key element in managing the project area, common to all four resource allocations, is the emphasis which must be given to recreation resources. Providing quality recreation opportunities throughout the NRA is an indisputable component of both the original legislation and the current management plan. The scope of public interest in management of the Hells Canyon NRA confirms the National significance of its recreational environment.

Hells Canyon NRA offers a long season of use and a diverse range of recreational opportunities. The same mild winter climate, abundance of wild game, and timeless natural beauty that beckoned early explorers and settlers to Hells Canyon now attracts recreationists from all parts of the United States. Recreation use of the area began during the 1940s, when outfitters and guides introduced adventurers to the Snake River canyon in wooden boats and rubber rafts. An interest in "river running" increased rapidly, encouraged by the availability of durable and inexpensive rubber rafts which were surplussed by the armed forces after World War II. Increased river use gave rise to increased interest in sport fishing and big game hunting. Both of these activities have become well established uses of the NRA. During the 1950s, horsepacking began gaining popularity, followed by a boom of backpacking in the late 1960s and early 1970s. These activities brought thousands of visitors to many remote parts of the area. Since the establishment of the NRA in 1975, the development of roads, trails, camping areas, and interpretive sites has encouraged continued recreational use of this unique National resource.

The timeless natural beauty of Hells Canyon NRA attracts visitors from across the Nation.

Recreation Opportunity Spectrum--The Recreation Opportunity Spectrum (ROS) is a planning tool which provides a framework for defining recreation opportunities and discerning public interest. It also identifies what portion of the recreation spectrum a given land base might provide. When the Comprehensive Management Plan (CMP) was written to provide direction for management of Hells Canyon NRA, ROS was just emerging as a planning and management concept. Consequently, it was not formally addressed in that planning process.

To evaluate the effects of project alternatives on recreation resources, an inventory of recreation settings and opportunities is necessary. The four CMP resource allocations, and the criteria which are used to define recreation settings, must be considered when describing and inventorying uses of the project area. The settings associated with these CMP allocations define a spectrum of recreational environments and opportunities that closely represents three ROS classes: Semiprimitive Nonmotorized, Semiprimitive Motorized, and Roaded Natural.

The setting of the *Semiprimitive Nonmotorized* class is characterized by a predominately natural or natural-appearing environment of moderate to large size. The setting may have subtle modifications that would be noticed but would not draw the attention of an observer wandering through the area. Interaction between users is low, but there is often evidence of other users. There is a high probability of experiencing independence, closeness to nature, tranquility, and self-reliance through the application of woodsman and outdoor skills in an environment that offers challenge and risk. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is not permitted.

The setting of the *Semiprimitive Motorized* class is characterized by a predominately natural or natural-appearing environment of moderate to large size. The setting may have moderately dominant alterations but would not draw the attention of motorized observers on trails and primitive roads within the area. Concentration of users is low, but there is often evidence of other users. There is a moderate probability of experiencing independence, closeness to nature, tranquility, self-reliance, and isolation from the sights and sounds of humans through the application of woodsman and outdoor skills in an environment that offers challenge and risk. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is permitted.

The setting of the *Roaded Natural* class is characterized by a predominately natural-appearing environment with moderate evidence of the sights and sounds of humans. Such evidence will usually harmonize with the natural environment. The setting will offer modifications ranging from those which are easily noticed, to ones which are strongly dominant in the user's view. However, from sensitive travel routes and use areas (Sensitivity level 1 and 2), these alterations would remain unnoticed or visually subordinate. There is an equal probability of experiencing affiliation with other user groups and of experiencing isolation from the sights and sounds of humans. There is opportunity to have a high degree of interaction with the natural environment, but challenge and risk opportunities are not very important. Resource modification and utilization practices are evident, but harmonize with the natural environment. Construction standards and facilities' design provide access for conventional motorized use.

Although there are slight differences between the scope of CMP and ROS setting criteria, the ROS framework will be used to analyze the effects of each management alternative in the discussions which follow. Setting indicators include access, remoteness, site management, visitor management, social encounters, and visitor impacts. An additional setting indicator, visual characteristics, is discussed in the Visual Resources section of this chapter.

In the project area, big game hunting, sightseeing, camping, bird hunting, day hiking, mountain biking, and bird watching take place in all ROS classes. Because these activities can be pursued with varying levels of access, isolation, and independence, they are not confined to any particular area. However, most of this use occurs in the Roaded Natural area. Backpacking and horsepacking are prevalent in the Semiprimitive Nonmotorized and Semiprimitive Motorized classes because most of the trails are within these areas. Snowmobiling, all terrain vehicle travel, firewood cutting, and mushroom gathering usually occur only in the Roaded Natural class because this area contains gentler, more easily accessible country. For details of use levels and patterns, reviewers can consult the Recreation Resources section of Chapter III.

The effects of project implementation on recreation resources will vary among the alternatives. The variance will depend on how the proximity, intensity, and timing of recovery operations affect the quality of the recreation setting and the availability of specific recreation opportunities. Recovery activities with the greatest potential to affect recreation resources include those associated with timber salvage, road construction, trail maintenance, and site rehabilitation. These effects are analyzed for individual alternatives in the sections which follow.

It is important to understand that the ROS defines only a system of inventorying recreational settings and opportunities. ROS classes provide a framework for evaluating changes in those settings and opportunities. ROS provides no formal direction for the management of recreation resources in the NRA.

Limited access to remote areas offer unparalleled experiences of solitude and independence.

Effects Common to all Alternatives

Fire changed the appearance of the project area. The fire's intensity varied from a level which burned only light understory fuels or open grasslands to one which consumed all vegetation and blackened the landscape. Fire suppression activities also influenced the appearance of specific sites, where trees were cut and tractor lines were constructed to control the fire.

The fire will affect the way visitors feel about the area. Visitor perceptions and expectations will vary widely. While some may feel that the fire destroyed the area's beauty and reduced its capacity to provide quality recreation opportunities, others will view the changes as part of the area's ecology which has little effect on the quality of recreation.

The ROS inventory will remain constant, regardless of which management options are implemented. No acreage changes would occur in the opportunity classes. Although the recreation setting indicators would show some qualitative variance by alternative in the opportunity classes, the magnitude and duration of this variance is inconsequential within the ROS framework. Therefore, the area would retain its capacity to provide recreation opportunities that are consistent with the current ROS inventory and the CMP.

Administration and maintenance of certain activities and resources associated with the project area would continue, in accordance with annual operating plans. The road and trail systems would receive normal maintenance as scheduled. Access routes would be cleared of major obstacles, but some associated hazards may remain. Maintenance would permit recreational access to the area, but the amount accomplished will depend on the availability of maintenance funds.

Primary roads would be maintained for recreation access to the area. Open roads include Wellamotkin Drive (46), Cold Spring Ridge Road (4680), Deadhorse Ridge Road (4600760), Cemetery Ridge Road (4600780), and Cherry Creek Road (4600788). Reviewers can consult Appendix K for additional information on the status of roads in the project area.

Recreational use would remain relatively constant among the alternatives, but temporary shifts in activities would occur. Moderate increases (25 percent) in activities such as sightseeing and camping are estimated because the roads would be open and people are curious about how the fire changed the area. Day hiking, backpacking, horsepacking, and other trail uses could be limited by the timing of annual trail maintenance and by any hazards remaining after the maintenance is completed.

A major increase (1000 percent) in mushroom gathering is expected because of increased morel production and the desirability of this species. These changes in use would last only 1-3 years, and the activity will be subject to regulation by the NRA. A small increase in firewood cutting could occur because of the additional availability of dead wood, but the amount of use would also be subject to regulation by the NRA.

Decreases in big game hunting are expected because State agencies will take appropriate actions to protect wildlife. The magnitude and duration of this use change will depend on the protective actions taken. The amount of trail maintenance completed will have little effect on hunting, because hunters travel cross-country as often as they use the trails.

Minor annual fluctuations (5 percent deviation) are estimated in other recreation activities, but these fluctuations will be an effect of normal use patterns rather than an effect of the project activities. All estimates of use changes are based on past trends and professional judgement.

EFFECTS COMMON TO ALTERNATIVES G, H, AND J

This section discusses the general effect of proposed timber salvage operations on the recreation resources. Although each alternative prescribes salvage of different volumes of timber, using different combinations of logging systems, many effects are common to Alternatives G, H, and J. Alternative I is not discussed, because it salvages no timber. The magnitude and duration of the effects of timber salvage under each alternative would be consistent with direction provided by the CMP, and would not exceed the recreation setting criteria for the affected ROS classes.

Recreation opportunities would vary with respect to the environments, activities, and experiences available during the recovery period. Because no salvage will occur in Semiprimitive Nonmotorized areas, and because no salvage will occur near recreation sites in Semiprimitive Motorized areas, the effect on the recreation setting in these ROS classes would be inconsequential. The setting in the Roaded Natural ROS class would be altered by timber salvage activities and the rehabilitation of resources which were impacted by fire suppression activities.

Probable consequences of timber salvage and fire suppression rehabilitation in the Roaded Natural class would include road, trail, and site closures; stump fields and slash piles; new roads, skid trails, and skyline corridors; landing and yarding areas; noise and dust; log truck and helicopter traffic; and use conflicts between recreationists and logging contractors. Most of these effects would be temporary, lasting only through the period of salvage operations. Other effects, such as stumps and residual evidence of the salvage, will be apparent until obscured by vegetative recovery (approximately 20 years).

Mitigation measures would protect identified recreation sites and trails. To retain the integrity of recreation sites, trees around dispersed campsites, water sources, trailheads, viewpoints, and trail corridors would not be salvaged. Skidding restrictions would also minimize disturbance to these sites. Stumps would be cut flush to the ground in foreground areas to minimize aesthetic impacts. Salvage operations would be prohibited during high use periods, such as Fourth of July, Labor Day, and opening weekends of deer and elk hunting seasons. These prohibitions would help minimize conflicts between recreation use and logging activity. Reviewers can consult Chapter II for a complete list of mitigation measures.

Timber salvage would indirectly benefit recreation resources. Roads upgraded for log haul would also improve recreation access. Additional public safety would be provided with the improvement of travel routes. Some segments of Roads 4680, 4690, 4625, and 4600780 would be resurfaced.

Salvage harvest would reduce the future accumulation of downed timber. This reduction would facilitate access to and travel within the Roaded Natural class. Less accumulation of downed timber provides improved opportunities for gathering forest products, and for hunting and hiking.

To enhance public safety, high risk hazard trees along trail corridors in the DR/TM allocation would be salvaged. High risk hazard trees along trail corridors in the Forage and DR/NV allocations would be felled for public safety. Hazard trees exceeding 24" in diameter would be salvaged in the Forage allocation.

In addition to the above benefits, opportunities may exist for developing Knutson-Vandenberg plans for improving campsites, water sources, and trailheads, and for developing scenic interpretive services viewpoints along travel routes. These opportunities would be explored as salvage contracts are prepared.

EFFECTS SPECIFIC TO ALTERNATIVE A

Alternative A is the no-action proposal. Under this alternative no changes in the post-fire situation would occur, except for annually scheduled road and trail maintenance. The consequences associated with no action are described below.

This alternative would not alter the post-fire recreation setting of the area. While the fire may have reduced the quality of recreation experiences for some visitors, it had little actual effect on the recreation opportunities available in the project area. The fire's overall effect can be perceived as a generally compatible influence on the recreation setting in each ROS class.

Under the No Action Alternative, no recovery of existing recreation sites would occur. The impacts of fire and fire suppression would remain. Resources affected by fireline construction and soil displaced by tractor operations at dispersed campsites, water sources, and trailheads would not be rehabilitated. Fallen trees which block access to recreation sites would remain, and hazard trees at recreation sites would not be removed. No facilities would be repaired or reconstructed. No seeding or planting to prevent resource deterioration at these sites would occur. Disrupted trail segments would remain, posing hazards for travelers and livestock. No new recreation features would be developed.

Because no timber would be salvaged, there would be no logging effects on recreation resources.

The effects of the fire and fire suppression would gradually be absorbed and obscured by natural processes of the ecosystem. The influences of natural processes would continue until affected by future management actions.

EFFECTS SPECIFIC TO ALTERNATIVE G

Implementation of Alternative G would provide recovery of recreation resources to their pre-fire conditions. Resources affected by the fire and by fire suppression would be rehabilitated at all recreation sites, but no sites or trails would be enhanced beyond their pre-fire condition. Access routes, hunter camps, water sources, trailheads, site facilities, and signing would be repaired, replaced, or restored as appropriate. No recreation sites would be buffered from the influence of salvage operations. Lack of screening of stumps and slash along road and trail corridors, and around dispersed campsites, water sources, and trailheads would depreciate the quality of the recreation setting in the Roaded Natural ROS class. The setting would also be temporarily impacted by the noise, dust, and traffic associated with logging operations. Alternative G establishes no new recreation features.

ROS Inventory--Alternative G proposes to salvage timber on 1,248 acres which are within 1/4-mile of these primary access roads: Wellamotkin Drive (46), Cold Spring Ridge Road (4680), Deadhorse Ridge Road (4600760), and Cemetery Ridge Road (4600780). Within 1/2-mile of these roads, 2,525 acres of timber would be salvaged. Most salvage is prescribed in the Roaded Natural ROS class.

Salvage activities would influence the setting of many dispersed camps along these roads. Campers and hunters could expect to see stumps, slash, and disturbed soil in the vicinity of salvage units. For the duration of the salvage activities, all recreationists could expect to encounter logging traffic on the roads and hear chainsaws and logging machinery in the vicinity of salvage units. The effects associated with salvage are described in "Effects Common to Alternatives G, H, and J." The following paragraphs describe the acreage and logging systems associated with these recreation access roads. The salvage planned in these areas is consistent with the setting criteria for the Roaded Natural ROS class, and meets the direction provided in the CMP.

In the 1/4-mile corridors, tractor logging is prescribed for 895 acres, cable logging for 67 acres, and helicopter logging for 286 acres. In the 1/2-mile corridors, tractor logging is prescribed for 1,604 acres, cable logging for 150 acres, and helicopter logging for 771 acres.

Tractor logging would be heaviest along Wellamotkin Drive, where 28 salvage units (534 acres) lay within 1/4-mile of the road. Many of these salvage units border or contain dispersed campsites. The Fairchild Point, Cottonwood Creek, Cold Spring Junction, Deadhorse Junction, and several of the 46 Corridor hunting camps would be directly affected.

On the Cold Spring Ridge Road, 9 salvage units (198 acres) lay within 1/4-mile of the road. On the Deadhorse Ridge Road, 6 salvage units (115 acres) lay within the 1/4-mile corridor, and on the Cemetery Ridge Road, 1 salvage unit (16 acres) is within 1/4-mile of the road. Two major sites that would be affected are the Cold Spring Ridge and Buckhorn Ridge hunter camps. However, many of the proposed salvage units border or contain other dispersed hunter camps along these road corridors.

Most cable and helicopter logging associated with these roads would occur along Wellamotkin Drive, Cold Spring Ridge Road, and Deadhorse Ridge Road. This logging would be in areas inaccessible to tractors and well away from dispersed campsites. The effect of salvage on recreation would be manifested primarily through increased logging traffic on the road system. No known campsites would be affected.

In the Roaded Natural ROS class, 3.9 miles of permanent roads and 1.3 miles of temporary roads would be constructed. Because these roads would be used only for timber salvage operations and would be closed following the salvage, operations would have inconsequential effects on recreation settings and use patterns.

Closed roads include the northernmost segment (2.1 miles) of Cemetery Ridge Road (4600780), the northernmost segment (1.2 miles) of Deadhorse Ridge Road (4600760), and the entire length of Wildhorse Ridge Road (4600596). Road closures on Cemetery Ridge and Deadhorse Ridge would be permanent, but the Wildhorse Ridge closure would be in effect only until wildlife cover becomes established (approximately 20 years). The Cemetery Ridge closure also permanently closes the Eureka Creek Trail (1732) to motorized vehicles. The permanent closures would reduce motorized use and road density within the area, and would help prevent recreation/wildlife conflicts in the DR/NV allocation. These road closures would also require that Cemetery Ridge, Eureka Creek, and Deadhorse Ridge trailheads be relocated. The relocations and their expected effects are described below. For further details on the status of roads in the project area, reviewers can consult Appendix K.

Activities and Use- In addition to the effects on recreation activities described under "Effects Common to All Alternatives", Alternative G would further displace visitors and influence use patterns. Visitors seeking campsites would probably avoid areas nearest the salvage operations. Some visitors would choose not to camp anywhere in the project area because of the traffic and noise generated by logging operations.

Areas, roads, and/or trails closed by logging contractors for public safety would also limit access to and use of those portions of the project area. These closures would limit day hiking, backpacking, horsepacking, and mountain biking opportunities. Because most of the primary access roads would remain open, sightseeing would be less impacted. Some visitors would probably be interested in viewing salvage activities, as well as areas affected by the fire.

Hunting is the activity which would be most negatively affected by salvage. Since most of the logging is planned in heavily hunted areas, game could be scarce and hunter success low. Mitigation measures will reduce conflict between hunting and logging during the heaviest use days. For example, all salvage operations will be prohibited during the two days before and after the opening days of rifle deer and elk seasons (total of five days each).

Salvage activity would have little effect on winter use. Snowmobiling would continue near its present level, and plowed roads could encourage some cross-country skiing use in the area.

The effects described above would be temporary, lasting only through the salvage period. For a more detailed description of contemporay activities and use, reviewers can consult the Recreation Resources section of Chapter III.

Dispersed Campsites--In the vicinity of the campsites listed below, areas where firelines were constructed and where soil was displaced by tractor operations would be returned to their natural repose. Access routes would be cleared of fallen trees, and the fuelwood would be left at campsites for recreational use. High risk hazard trees on sites in the DR/TM allocation would be salvaged, and high risk hazard trees on sites in other resource allocations would be felled for recreation firewood. Burned sites would be seeded or planted with indigenous species, as necessary, to prevent resource deterioration. The recovery of all campsites would be completed within 2 years. These campsites are displayed on the Resource Recovery map for Alternative G. The total estimated cost of recovering all sites is $16,600.

Buckhorn Spring Campground
Buckhorn Ridge Hunter Camp
Cherry Creek Hunter Camp
Cold Spring Junction Hunter Camp
Cold Spring Ridge Hunter Camp
Cottonwood Creek Hunter Camp
Deadhorse Junction Hunter Camp
Deadhorse Ridge Hunter Camp
Downey Saddle Hunter Camp
Fairchild Point Hunter Camp
Five Points Creek Hunter Camp
Wildhorse Ridge Hunter Camp
Road 46 Corridor Hunting Camps
Road 4680 Corridor Hunting Camps
Road 4600760 Corridor Hunting Camps
Road 4600596 Corridor Hunting Camps

Water Sources--Eight water sources are near dispersed campsites within the project area. In the vicinity of the water sources listed below, areas where firelines were constructed and where soil was displaced by tractor operations would be returned to their natural repose. Access routes would be cleared for foot traffic. Spring boxes and exclosures would be reconstructed, and runoff ponds would be cleared of burned debris. High risk hazard trees on sites in the DR/TM allocation would be salvaged, and high risk hazard trees on sites in other resource allocations would be cleared as they fall. Burned sites would be seeded or planted, as necessary, to prevent resource deterioration. The recovery of all water resources would be completed within 2 years. These water sources are displayed on the Resource Recovery map for Alternative G. The total estimated cost of recovering all sites is $10,200.

- Box Spring
- Buckhorn Spring
- Cottonwood Spring
- Deadhorse Spring
- Downey Spring
- Fairchild Spring
- Frog Pond
- Old Cold Spring

Trailheads--Eleven trailheads are within the project area. In the vicinity of the trailheads listed below, areas where firelines were constructed and where soil was displaced by tractor operations would be returned to their natural repose. Access routes and parking areas would be cleared of fallen trees. High risk hazard trees on sites in the DR/TM allocation would be salvaged, and high risk hazard trees on sites in other resource allocations would be removed for public safety. Burned sites would be seeded or planted, as necessary, to prevent resource deterioration. The recovery of all trailheads would be completed within 2 years. These trailheads are displayed on the Resource Recovery map for Alternative G. The total estimated cost of recovering all sites is $4,600.

Cemetery Ridge Trailhead	1731
Chalk Creek Trailhead	1702
Cherry Creek Trailhead	1705
Cook Creek Trailhead	1697
Cottonwood Creek Trailhead	1696
Deadhorse Creek Trailhead	1708
Dry Creek Trailhead	1704
Eureka Creek Trailhead	1732
Five Points Trailhead	1697A
Imnaha Breaks Trailhead	1713.1
Old Man Creek Trailhead	1719

Trails--The existing trail system within the project area, totaling 57.8 miles, would be maintained for recreational access. Each trail would be cleared of hazards and burned debris. Normal maintenance would be performed over 18.6 miles, and more intensive maintenance would be required to clear an additional 33.3 miles. Additional reconstruction of 5.9 miles of disrupted segments would return the trail system to its pre-fire condition.

High risk hazard trees along trail corridors would be felled for public safety. Preliminary reconnaissance estimates the average number of hazard trees along trail corridors in the lightly burned areas to be 5 trees per mile. Along the moderately burned trail corridors the average is 15 hazard trees per mile. Along heavily burned corridors hazard trees average 30 per mile.

The recovery of all trails would be completed within 2 years. Trails listed below would receive such maintenance. The total estimated cost of recovering all trails is $166,600. Reviewers can consult the Resource Recovery map for Alternative G and the Recreation Feature Prescriptions in Appendix H for maintenance details.

Cemetery Ridge Trail	1731
Chalk Creek Trail	1702
Cherry Creek Trail	1705
Cook Creek Trail	1697
Cottonwood Creek Trail	1696
Deadhorse Creek Trail	1708
Dry Creek Trail	1704
Eureka Creek Trail	1732
Five Points Creek Trail	1697A
Imnaha Breaks Trail	1713.1
Old Man Creek Trail	1719

EFFECTS SPECIFIC TO ALTERNATIVE H

Implementation of Alternative H would provide a moderate level of enhancement of recreation resources. Resources affected by fire and by fire suppression activities at all recreation sites and along all trails would be rehabilitated, and selected sites or trails would be enhanced beyond their pre-fire condition. Site enhancement would be consistent with ROS guidelines. Access routes, hunter camps, water sources, trailheads, site facilities, and signing would be repaired, replaced, or restored as appropriate. Under this alternative, several sites would be relocated to complement recreation needs, and trails would be improved to a level consistent with current management objectives. Although the amount of salvage prescribed is relatively light, no recreation sites would be buffered from the effects of salvage operations. Lack of screening of stumps and slash along road and trail corridors and around dispersed campsites, water sources, and trailheads would depreciate the quality of the recreation setting in portions of the Roaded Natural ROS class. The setting will also be partially affected by the noise, dust, and traffic associated with logging operations. Alternative H establishes 5 new interpretive viewpoints and 1 new interpretive trail.

ROS Inventory--Alternative H proposes to salvage timber on 388 acres which are within 1/4-mile of these primary access roads: Wellamotkin Drive (46), Cold Spring Ridge Road (4680), Deadhorse Ridge Road (4600760), and Cemetery Ridge Road (4600780). Within 1/2-mile of these roads, timber on 805 acres would be salvaged. Most of this salvage would be in the Roaded Natural ROS class.

Salvage activities would influence the setting of many dispersed campsites along these roads. Campers and hunters could expect to see stumps, slash, and disturbed soil in the vicinity of the salvage units. For the duration of the salvage activities all recreationists could expect to encounter logging traffic on the roads and to hear chainsaws and logging machinery in the salvage units. The effects associated with the salvage are described in "Effects Common to Alternatives G, H, and J". The following paragraphs describe the acreage and logging systems associated with these recreation access roads. The salvage planned in these areas is consistent with the setting criteria for the Roaded Natural ROS class, and meets the direction provided in the CMP.

In the 1/4-mile corridors, tractor logging is prescribed for 316 acres, cable logging for 7 acres, and helicopter logging for 65 acres. In the 1/2-mile corridors, tractor logging is prescribed for 590 acres, cable logging for 27 acres, and helicopter logging for 188 acres.

Tractor logging would be heaviest along Wellamotkin Drive where 7 salvage units (132 acres) lay within 1/4-mile of the road. Many of these salvage units border or contain dispersed campsites. The Fairchild Point, Cottonwood Creek, Cold Spring Junction, and several of the 46 Corridor hunting camps would be the most directly affected.

On the Cold Spring Ridge Road, 4 salvage units (100 acres) lay within 1/4-mile of the road. On the Deadhorse Ridge Road, 2 salvage units (37 acres) lay within the 1/4-mile corridor, and on the Cemetery Ridge Road, 1 salvage unit (16 acres) is within 1/4-mile of the road. Two major sites that would be affected are the Cold Spring Ridge and Buckhorn Ridge hunter camps. However, many of these salvage units border or contain other dispersed hunter camps along these road corridors.

Most cable and helicopter logging associated with these roads would occur along Wellamotkin Drive, Cold Spring Ridge Road, and Deadhorse Ridge Road. This logging would be in areas inaccessible to tractors and well away from dispersed campsites. The effect of salvage on recreation would be manifested primarily through increased logging traffic on the road system. No known campsites would be affected.

In the Roaded Natural ROS class, 2.7 miles of permanent roads and 0.4 miles of temporary roads would be constructed. Because these roads would be used only for timber salvage operations and would be closed following the salvage, they would have inconsequential effects on recreation settings and use patterns.

Closed roads include the northernmost segment (2.1 miles) of Cemetery Ridge Road (4600780), the northernmost segment (1.2 miles) of Deadhorse Ridge Road (4600760), and the entire length of Wildhorse Ridge Road (4600596). The closures on Cemetery Ridge and Deadhorse Ridge would be permanent, but the Wildhorse Ridge closure would be in effect only until wildlife cover becomes established (approximately 20 years). The Cemetery Ridge closure would also permanently close the Eureka Creek Trail (1732) to motorized vehicles. The permanent closures would reduce motorized use and road density within the area, and would help prevent recreation/wildlife conflicts in the DR/NV allocation. These road closures would also require that Cemetery Ridge, Eureka Creek, and Deadhorse Ridge trailheads be relocated. The relocations and their expected effects are described below. For further details on the status of roads in the project area, reviewers can consult Appendix K.

Activities and Use--In addition to the effects on recreation activities and use described under "Effects Common to All Alternatives", Alternative H would further displace visitors and influence use patterns. Visitors seeking campsites would probably avoid the areas near salvage operations. Some visitors would choose not to camp anywhere in the project area because of the traffic and noise generated by logging operations.

Areas, roads, and/or trails closed by logging contractors would also limit access to and use of those portions of the project area. Such closures would limit day hiking, backpacking, horsepacking, and mountain biking opportunities. Because most of the primary access roads would remain open, sightseeing would be less impacted. Some visitors would probably be interested in viewing salvage activities, as well as areas affected by the fire.

Hunting is the activity which would be most negatively affected by salvage. Since most of the logging is planned in heavily hunted areas, game could be scarce and hunter success low. Mitigation measures will reduce conflict between hunting and logging during the heaviest use days. For example, all salvage operations would be prohibited during the two days before and after opening days of rifle deer and elk seasons (total of five days each).

Salvage activity would have little effect on winter use. Snowmobiling would continue near its present level, and plowed roads could encourage some cross-country skiing use in the area.

The effects described above would be temporary, lasting only through the salvage period. For a more detailed description of existing activities and use, reviewers can consult the Recreation Resources section of Chapter III.

Dispersed Campsites--In the vicinity of the following campsites, areas where firelines were constructed and where soil was displaced by tractor operations would be returned to their natural repose. Access routes would be cleared of fallen trees, and the fuelwood would be left at campsites for recreational use. High risk hazard trees on sites in the DR/TM allocation would be salvaged, and high risk hazard trees on sites in other resource allocations would be felled for recreation firewood. Burned sites would be seeded or planted with indigenous species, as necessary, to prevent resource deterioration. The recovery of all campsites would be completed within 2 years. These campsites are displayed on the Resource Recovery map for Alternative H. The total estimated cost of recovering all sites is $16,600.

Buckhorn Spring Campground
Buckhorn Ridge Hunter Camp
Cherry Creek Hunter Camp
Cold Spring Junction Hunter Camp
Cold Spring Ridge Hunter Camp
Cottonwood Creek Hunter Camp
Deadhorse Junction Hunter Camp
Deadhorse Ridge Hunter Camp
Downey Saddle Hunter Camp
Fairchild Point Hunter Camp
Five Points Creek Hunter Camp
Wildhorse Ridge Hunter Camp
Road 46 Corridor Hunting Camps
Road 4680 Corridor Hunting Camps
Road 4600760 Corridor Hunting Camps
Road 4600596 Corridor Hunting Camps

Water Sources--Eight water sources are near dispersed campsites within the project area. In the vicinity of the water sources listed below, areas where firelines were constructed and where soil was displaced by tractor operations would be returned to their natural repose. Access routes would be cleared for foot traffic. Spring boxes and exclosures would be reconstructed, and runoff ponds would be cleared of burned debris. High risk hazard trees on sites in the DR/TM allocation would be salvaged, and high risk hazard trees on sites in other resource allocations would be cleared as they fall. Burned sites would be seeded or planted, as necessary, to prevent resource deterioration. The recovery of all water sources would be completed within 2 years. These water sources are displayed on the Resource Recovery map for Alternative H. The total estimated cost of recovering all sites is $10,200.

Box Spring
Buckhorn Spring
Cottonwood Spring
Deadhorse Spring
Downey Spring
Fairchild Spring
Frog Pond
Old Cold Spring

Trailheads--Eleven trailheads are within the project area. In the vicinity of the following trailheads, areas where firelines were constructed and where soil was displaced by tractor operations would be returned to their natural repose. Burned sites would be seeded or planted, as necessary, to prevent resource deterioration. The total estimated cost of recovering all sites is $4,600.

Cemetery Ridge Trailhead	1731
Chalk Creek Trailhead	1702
Cherry Creek Trailhead	1705
Cook Creek Trailhead	1697
Cottonwood Creek Trailhead	1696
Deadhorse Creek Trailhead	1708
Dry Creek Trailhead	1704
Eureka Creek Trailhead	1732
Five Points Trailhead	1697A
Imnaha Breaks Trailhead	1713.1
Old Man Creek Trailhead	1719

Three trailheads would be relocated, and eight trailheads would be consolidated into four sites. This would improve access, expand parking, screen the sites from travel corridors, reduce conflicts with range resources, enhance public safety, and increase the efficiency of administration and maintenance. The sites would be cleared for parking and access, and high risk hazard trees would be removed. Signing, hitchracks, and stock ramps would be provided. Previous sites would be cleaned-up, and all burned facilities would be removed. All relocation and consolidation would be accomplished within 3 years. The new sites would provide permanent access to trails. For specific locations and site prescriptions for trailheads, reviewers can consult Appendix H and the Resource Recovery map for Alternative H. The total estimated cost of relocating and/or consolidating trailheads, and of constructing the associated facilities is $19,500.

The following trailheads would be relocated:

Cottonwood Creek Trailhead	1696
Five Points Creek Trailhead	1697A
Imnaha Breaks Trailhead	1713.1

The Cottonwood Creek Trailhead is accessed by Road 4600670. A portion of this road is over a north aspect, and retains mud and snow after other portions of the road have dried. There is no designated parking area near the trailhead; vehicles must be parked along the road. There are no facilities on-site, and signing is inadequate. Vegetation around the trailhead sustained heavy damage during the fire, diminishing the appeal of the setting.

The Cottonwood drainage was highlighted in a recently published hiking guide, and use will probably increase in the area. Relocation to a site which is not on a north aspect would provide convenient and safe access to the trail during the spring and fall. The new site would provide adequate parking and screening from the road. Improved signing and simple livestock facilities would be provided. A 0.2-mile trail would connect the new site with the existing Cottonwood Creek Trail.

The Five Points Creek Trailhead is accessed by Road 4680. Access is adequate, but vehicles must be parked adjacent to the road. No screening or facilities exist, signing is inadequate, and the trail is difficult to find. The Five Points drainage was also highlighted in the hiking guide.

The new trailhead site would provide adequate parking and screening from the road. Signing and livestock facilities would be installed. Water for livestock is already available. This site would also provide visitors with a dramatic view of the drainages east of Cold Spring Ridge. There would be opportunities to provide services for interpreting the role of fire and fire management in the NRA. A 0.3-mile trail would connect the new site with the existing Five Points Creek Trail.

The Imnaha Breaks Trailhead is accessed by Road 4600788. Access is adequate, but no screening exists. No facilities are available, and parking is very limited.

A bench above the road would provide the trailhead adequate screening from the road and parking area. Signing and livestock facilities would be provided, and a 0.2-mile trail would connect the new site with the existing Imnaha Breaks Trail.

The following trailheads would be consolidated:

Cemetery/Eureka Trailheads	1731/1732
Cherry/Chalk Trailheads	1705/1702
Cook/Old Man Trailheads	1697/1719
Dry/Deadhorse Trailheads	1704/1708

The Cemetery Creek and Eureka Creek Trailheads are accessed by Road 4600780. Because the northernmost segment (2.1 miles) of this road is closed under all of the action alternatives, relocating these trailheads is necessary to provide vehicle access.

The two trailheads would be consolidated at a site just south of the boundary between the DR/NV and DR/TM allocations where the road closure begins. The road to this site would be improved, and the site would provide adequate space for parking and facilities. At the new site there would be opportunities for providing services to interpret fire management within the NRA as well as its cultural history and plant communities.

The Cherry Creek and Chalk Creek Trailheads are currently located at the Cherry Creek Ranch. They are accessed by Road 4600788. During the spring and fall months the last 1 mile segment of access is restricted to 4-wheel-drive vehicles, and is periodically restricted during all seasons by a locked gate. Visitor parking occasionally conflicts with range permittee operations and administrative field activities. The fire burned intensely through the Cherry Creek Ranch, creating hazards in accessing the trail.

The two trailheads would be consolidated at another site to circumvent the gate and to avoid conflict with range and administrative uses. The proposed site would provide adequate parking, facilities, and water. This site would provide access to an existing 0.5-mile trail along Cherry Creek which intersects the Cherry Creek and Chalk Creek Trails. The new trailhead would offer many improvements in visitor access to these trails.

The Cook Creek and Old Man Creek Trailheads are accessed by Road 4600760. Because the northernmost segment (1.2 miles) of this road is closed under all of the action alternatives, relocating the Old Man Creek Trailhead is necessary to provide vehicle access.

The two trailheads would be consolidated at one site, just south of the boundary between the DR/NV and DR/TM allocations where the road closure begins. This location is very close to the present Cook Creek Trailhead. The road to the proposed site would be improved, and the site would provide adequate space for parking and facilities. At the new site there would be opportunities to provide services for interpreting the role of fire and fire management in the NRA.

The Dry Creek and Deadhorse Creek Trailheads are accessed by Road 4680. Access to the Dry Creek Trailhead is adequate, but not to the Deadhorse Trailhead. The latter is located at the Cold Spring Cow Camp where access is blocked by a locked gate 0.8 miles above the trailhead on Road 4680150. The fire burned intensely through the cow camp, and the site should be avoided by recreationists. No trailhead facilities exist at either site.

The two trailheads would be consolidated at another site, located 0.2 miles south of the present Dry Creek site on the west side of Road 4680. This location would improve access and reduce conflicts with range permittee operations. It would provide adequate parking and screening from the road. Signing and livestock facilities would be installed. Water for livestock is already available. The proposed site would provide a scenic viewpoint and excellent opportunities for providing interpretive services.

Trails--The existing trail system within the project area, totaling 57.8 miles, would be maintained for recreational access. Each trail would be cleared of hazards and burned debris and upgraded to a level consistent with current management objectives. Each trail would be cleared of hazards and burned debris. Normal maintenance would be performed over 13.0 miles, and more intensive maintenance would be required to clear an additional 29.6 miles. Additional reconstruction of 13.2 miles of disrupted segments would improve the trail system to a level consistent with current management objectives.

High risk hazard trees along trail corridors would be felled for public safety. Preliminary reconnaissance estimates the average number of hazard trees along trail corridors in the lightly burned areas to be 5 trees per mile. Along the moderately burned trail corridors the average is 15 hazard trees per mile. Along heavily burned corridors hazard trees average 30 per mile.

This level of maintenance would substantially improve the pre-fire condition of the trail system. It would require an estimated initial investment of $308,800 above the minimum level of recovery proposed under Alternative G, and would require approximately 5 years to accomplish. The following trails, displayed on the Resource Recovery map for Alternative H, would be included. Reviewers can consult the Recreation Feature Prescriptions in Appendix H for maintenance details.

Cemetery Ridge Trail	1731
Chalk Creek Trail	1702
Cherry Creek Trail	1705
Cook Creek Trail	1697
Cottonwood Creek Trail	1696
Deadhorse Creek Trail	1708
Dry Creek Trail	1704
Eureka Creek Trail	1732

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Five Points Creek Trail	1697A
Imnaha Breaks Trail	1713.1
Old Man Creek Trail	1719

Interpretive Sites--Five sites would be constructed to provide interpretive services facilities for describing the role of fire and fire management, and the history and ecology of the project area. Display design would be simple, rustic, and complementary with ROS setting criteria. Site access would be by road or trail, and views from these sites would be among the most scenic in the project area. They would be developed within 3 years and would be maintained as permanent facilities. For further information regarding specific locations of and site prescriptions for each of these sites, reviewers can consult Appendix H and the Resource Recovery map for Alternative H. The estimated cost of establishing these sites is $5,400.

Cemetery Ridge Lookout
Cold Spring Ridge/Cook Creek Viewpoint
Deadhorse Ridge Viewpoint
Fairchild Point Lookout
Frog Pond

EFFECTS SPECIFIC TO ALTERNATIVE I

Implementation of Alternative I would provide the maximum level of recreation resource enhancement of the alternatives considered. Resources which were affected by the fire and by fire suppression activities would be rehabilitated, and selected sites or trails would be enhanced beyond their pre-fire condition. Site enhancement would be consistent with ROS guidelines. Access routes, hunter camps, water sources, trailheads, site facilities, and signing would be repaired, replaced, or restored as appropriate. This alternative proposes to relocate and consolidate selected trailheads, develop new sites, improve visitor access; and it promotes increased public use of the primary road corridors. Because this alternative promotes recreation development and salvages no timber, the quality of the recreation setting would be enhanced. Alternative I establishes 11 new interpretive services viewpoints, 2 new trailheads, 2 new access trails, and 1 new interpretive trail.

ROS Inventory--Because Alternative I proposes additional recreation developments but salvages no timber, no negative effects on recreation resources would be anticipated. The development planned under this alternative is consistent with the setting criteria for each ROS class, and it meets direction provided in the CMP. Except for the following road closures, there would be no effects on recreation activities and use beyond those described in "Effects Common to All Alternatives." For a more detailed description of contemporary activities and use, reviewers can consult the Recreation Resources section of Chapter III.

Closed roads include the northernmost segment (2.1 miles) of Cemetery Ridge Road (4600780), the northernmost segment (1.2 miles) of Deadhorse Ridge Road (4600760), and the entire length of Wildhorse Ridge Road (4600596). The closures on Cemetery Ridge and Deadhorse Ridge would be permanent, but the Wildhorse Ridge closure would be in effect only until wildlife cover becomes established (approximately 20 years). The Cemetery Ridge closure also permanently closes the Eureka Creek Trail (1732) to motorized vehicles. The permanent closures would reduce motorized use and road density within the area, and would help prevent recreation/wildlife conflicts within the DR/NV allocation. These road closures would also require that Cemetery Ridge, Eureka Creek, and Deadhorse Ridge trailheads be relocated. The relocations and their expected effects are described below. For further details on the status of roads in the project area, reviewers can consult Appendix K.

Activities and Use--There would be no effects on recreation activities and use beyond those described in "Effects Common to All Alternatives." For a more detailed description of contemporary activities and use, reviewers can consult the Recreation Resources section of Chapter III.

Dispersed Campsites--In the vicinity of the following campsites, areas where firelines were constructed and where soil was displaced by tractor operations would be returned to their natural repose. Access routes would be cleared of fallen trees, and the fuelwood would be left at campsites for recreational use. High risk hazard trees at sites in the DR/TM allocation would be salvaged, and high risk hazard trees on sites in other resource allocations would be felled for recreation firewood. Burned sites would be seeded or planted with indigenous species, as necessary, to prevent resource deterioration. The recovery of all campsites would be completed within 2 years. These campsites are displayed on the Resource Recovery map for Alternative I. The total estimated cost of recovering all sites is $16,600.

Buckhorn Spring Campground
Buckhorn Ridge Hunter Camp
Cherry Creek Hunter Camp
Cold Spring Junction Hunter Camp
Cold Spring Ridge Hunter Camp
Cottonwood Creek Hunter Camp
Deadhorse Junction Hunter Camp
Deadhorse Ridge Hunter Camp
Downey Saddle Hunter Camp
Fairchild Point Hunter Camp
Five Points Creek Hunter Camp
Wildhorse Ridge Hunter Camp
Road 46 Corridor Hunting Camps
Road 4680 Corridor Hunting Camps
Road 4600760 Corridor Hunting Camps
Road 4600596 Corridor Hunting Camps

Water Sources--Eight water sources are near dispersed campsites within the project area. In the vicinity of the water sources listed below, areas where firelines were constructed and where soil was displaced by tractor operations would be returned to their natural repose. Access routes would be cleared for foot traffic. Spring boxes and exclosures would be reconstructed, and runoff ponds would be cleared of burned debris. High risk hazard trees on sites in the DR/TM allocation would be salvaged, and high risk hazard trees on sites in other resource allocations would be cleared as they fall. Burned sites would be seeded or planted, as necessary, to prevent resource deterioration. The recovery of all water sources would be completed within 2 years. These water sources are displayed on the Resource Recovery map for Alternative I. The total estimated cost of recovering all sites is $10,200.

Box Spring
Buckhorn Spring
Cottonwood Spring
Deadhorse Spring
Downey Spring

Fairchild Spring
Frog Pond
Old Cold Spring

Trailheads--Eleven trailheads are within the project area. In the vicinity of the following trailheads, areas where firelines were constructed and soil was displaced by tractor operations would be returned to their natural repose. Burned sites would be seeded or planted, as necessary, to prevent resource deterioration. The total estimated cost of recovering all sites is $4,600.

Cemetery Ridge Trailhead	1731
Chalk Creek Trailhead	1702
Cherry Creek Trailhead	1705
Cook Creek Trailhead	1697
Cottonwood Creek Trailhead	1696
Deadhorse Creek Trailhead	1708
Dry Creek Trailhead	1704
Eureka Creek Trailhead	1732
Five Points Trailhead	1697A
Imnaha Breaks Trailhead	1713.1
Old Man Creek Trailhead	1719

Three trailheads would be relocated, and eight trailheads would be consolidated into four sites. This would improve access, expand parking, screen the sites from travel corridors, reduce conflicts with range resources, enhance public safety, and increase the efficiency of administration and maintenance. The sites would be cleared for parking and access, and high risk hazard trees would be removed. Signing, hitchracks, and stock ramps would be provided. Previous sites would be cleaned-up, and all burned facilities would be removed. All relocation and consolidation would be accomplished within 3 years. The new sites would provide permanent access to trails. For specific locations and site prescriptions for trailheads, reviewers can consult Appendix H and the Resource Recovery map for Alternative I. The estimated cost of the relocating and consolidating trailheads and constructing the associated facilities is $19,500.

The following trailheads would be relocated:

Cottonwood Creek Trailhead	1696
Five Points Creek Trailhead	1697A
Imnaha Breaks Trailhead	1713.1

The Cottonwood Creek Trailhead is accessed by Road 4600670. A portion of this road is over a north aspect, and retains mud and snow after other portions of the road have dried. There is no designated parking near the trailhead; vehicles must be parked along the road. There are no facilities on-site, and signing is inadequate. Vegetation around the trailhead sustained heavy damage during the fire, diminishing the appeal of the setting.

The Cottonwood drainage was highlighted in a recently published hiking guide, and use will probably increase in the area. Relocation to a site which is not on a north aspect would provide convenient and safe access to the trail during the spring and fall. The new site would provide adequate parking and screening from the road. Improved signing and simple livestock facilities would be provided. A 0.2-mile trail segment would connect the new site with the existing Cottonwood Creek Trail.

The Five Points Creek Trailhead is accessed by Road 4680. Access is adequate, but vehicles must be parked adjacent to the road. No screening or facilities exist, signing is inadequate, and the trail is difficult to find. The Five Points drainage was also highlighted in the hiking guide.

The new trailhead site would provide adequate parking and screening from the road. Signing and livestock facilities would be installed. Water for livestock is already available. This site also provides visitors with a dramatic view of the drainages east of Cold Spring Ridge. There would be opportunities to provide services for interpreting the role of fire and fire management in the NRA. A 0.3-mile trail would connect the new site with the Five Points Creek Trail.

The Imnaha Breaks Trailhead is accessed by Road 4600788. Access is adequate, but no screening exists. No facilities are available, and parking is very limited.

A bench above the road would provide the trailhead adequate screening from the road and parking area. Signing and livestock facilities would be provided, and a 0.2-mile trail would connect the new site with the Imnaha Breaks Trail.

The following trailheads would be consolidated:

Cemetery/Eureka Trailheads	1731/1732
Cherry/Chalk Trailheads	1705/1702
Cook/Old Man Trailheads	1697/1719
Dry/Deadhorse Trailheads	1704/1708

The Cemetery Creek and Eureka Creek Trailheads are accessed by Road 4600780. Because the northernmost segment (2.1 miles) of this road is closed under all of the action alternatives, relocating these trailheads is necessary to provide vehicle access.

The two trailheads would be consolidated at a site just south of the boundary between the DR/NV and DR/TM allocations where the road closure begins. The road to this site would be improved, and the new site would provide adequate space for parking and facilities. At the new site there would be opportunities for providing services to interpret fire management within the NRA as well as its cultural history and plant communities.

The Cherry Creek and Chalk Creek Trailheads are currently located at the Cherry Creek Ranch. They are accessed by Road 4600788. During the spring and fall months the last 1 mile segment of access is restricted to 4-wheel-drive vehicles, and is periodically restricted during all seasons by a locked gate. Visitor parking occassionally conflicts with range permittee operations and administrative field activities. The fire burned intensely through the Cherry Creek Ranch, creating hazards in accessing the trail.

The two trailheads would be consolidated at another site, to circumvent the gate and to avoid conflict with range and administrative uses. The proposed site would provide adequate parking, facilities, and water. This site would provide access to an existing 0.5-mile trail along Cherry Creek which intersects the Cherry Creek and Chalk Creek trails. The new trailhead would offer many improvements in visitor access to these trails.

The Cook Creek and Old Man Creek Trailheads are accessed by Road 4600760. Because the northernmost segment (1.2 miles) of this road is closed under all of the action alternatives, relocating the Old Man Creek Trailhead is necessary to provide vehicle access.

The two trailheads would be consolidated at one site, just south of the boundary between the DR/NV and DR/TM allocations where the road closure begins. This location is very close to the present Cook Creek Trailhead. The road to the proposed site would be improved, and the site would provide adequate space for parking and facilities. At the new site there would be opportunities to provide services for interpreting the role of fire and fire management in the NRA.

The Dry Creek and Deadhorse Creek Trailheads are accessed via Road 4680. Access to the Dry Creek Trailhead is adequate, but not to the Deadhorse Trailhead. The latter is located at the Cold Spring Cow Camp where access is blocked by a locked gate 0.8 miles above the trailhead on Road 4680150. The fire burned intensely through the cow camp, and the site should be avoided by recreationists. No trailhead facilities exist at either site.

The two trailheads would be consolidated at another site, 0.2 miles south of the present Dry Creek site on the west side of Road 4680. This location would improve access and reduce conflicts with range permittee operations. It would provide adequate parking and screening from the road. Signing and livestock facilities would be installed. Water for livestock is already available. This site would provide a scenic viewpoint and excellent opportunities for providing interpretive services.

Permanent bulletin boards and vault toilets costing approximately $85,000 would be provided at the following trailheads:

Cottonwood Creek Trailhead	1696
Five Points Creek Trailhead	1697A
Imnaha Breaks Trailhead	1713.1
Cemetery/Eureka Trailheads	1731/1732
Cherry/Chalk Trailheads	1705/1702
Cook/Old Man Trailheads	1697/1719
Dry/Deadhorse Trailheads	1704/1708

Two new trailheads would be constructed to facilitate visitor access and to enhance interpretive services in the area. Signing and parking would be provided at the trailheads. Livestock and sanitation facilities as well as interpretive displays would also be installed. For specific locations and site prescriptions, reviewers can consult Appendix H and the Resource Recovery map for Alternative I. These trailheads would be maintained as permanent facilities. The estimated cost of their construction is $23,600.

Bear Creek Trailhead
Howard Cutoff Trailhead

Trails--The existing trail system within the project area, totaling 57.8 miles, would be maintained for recreational access. Each trail would be cleared of hazards and burned debris and upgraded to a level consistent with current management objectives. Each trail would be cleared of hazards and burned debris. Normal maintenance would be performed over 13.0 miles, and more intensive maintenance would be required to clear an additional 29.6 miles. Additional reconstruction of 13.2 miles of disrupted segments would improve the trail system to a level consistent with current management objectives.

High risk hazard trees along trail corridors would be felled for public safety. Preliminary reconnaissance has estimated the average number of hazard trees along trail corridors in the lightly burned areas to be 5 trees per mile. Along the moderately burned trail corridors the average is 15 hazard trees per mile. Along intensely burned corridors hazard trees average 30 per mile.

This level of maintenance would substantially improve the pre-fire condition of the trail system. It would require an initial investment of approximately $308,800 above the minimum level of recovery proposed under Alternative G, and would require approximately 5 years to accomplish. The following trails, displayed on the Resource Recovery map for Alternative I, would be included. Reviewers can consult the Recreation Feature Prescriptions in Appendix H for maintenance details.

Cemetery Ridge Trail	1731
Chalk Creek Trail	1702
Cherry Creek Trail	1705
Cook Creek Trail	1697
Cottonwood Creek Trail	1696
Deadhorse Creek Trail	1708
Dry Creek Trail	1704
Eureka Creek Trail	1732
Five Points Creek Trail	1697A
Imnaha Breaks Trail	1713.1
Old Man Creek Trail	1719

Eureka Creek Trail would be improved to provide interpretive services for describing changes in life zones from the Buckhorn Rim to the Snake River. This project would be accomplished within 2 years, and the interpretation facilities would become a permanent part of the trail.

Two new trails would be constructed to facilitate visitor access and to enhance interpretative services in the area. 7.1 miles of trail tread construction would be required. For specific locations and site prescriptions, reviewers can consult Appendix H and the Resource Recovery map for Alternative I. These trails would be maintained as permanent facilities. The estimated cost of their construction is $121,200.

Bear Creek Trail
Howard Cutoff Trail

Interpretive Sites--Eleven sites would be constructed to provide interpretive services facilities for describing the role of fire and fire management, and the history and ecology of the area. Display design would be simple, rustic, and complementary with ROS setting criteria. Site access would be by road or trail, and views from these sites would be among the most scenic in the project area. They would be developed within 3 years and would be maintained as permanent facilities. For further information regarding the specific locations and site prescriptions for each of these sites, reviewers can consult Appendix H and the Resource Recovery map for Alternative I. The estimated cost of establishing these sites is $8,100.

Bear Ridge Viewpoint
Buckhorn Lookout
Cemetery Ridge Lookout
Cold Spring Ridge/Cook Creek Viewpoint
Cold Spring Ridge/Cottonwood Creek Viewpoint
Deadhorse Ridge Viewpoint
Eureka Creek Viewpoint
Fairchild Point Lookout
Frog Pond

Spain Saddle Viewpoint
Wildhorse Ridge Viewpoint

EFFECTS SPECIFIC TO ALTERNATIVE J

Implementation of Alternative J would provide a moderate level resource enhancement. Resources which were affected by the fire and by fire suppression activities around all recreation sites and along all trails would be rehabilitated, and selected sites or trails would be enhanced beyond their pre-fire condition. Site enhancement would be consistent with ROS guidelines. Access routes, hunter camps, water sources, trailheads, site facilities, and signing would be repaired, replaced, or restored as appropriate. This alternative proposes to relocate and consolidate selected sites and to make them into attractive and functional units. It would reduce conflicts between recreation and other resources. Most recreation sites would be buffered from the influence of salvage operations. A 300-foot vegetative buffer would be maintained along primary access roads to screen most evidence of logging. With appropriate buffer design, stumps and slash along roads, trail corridors and around dispersed campsites, water sources, and trailheads would be less noticeable. Within the Roaded Natural ROS class more compatibility between the salvage operations and recreation settings could be provided. However, some settings would be temporarily impacted by the noise, dust, and traffic associated with logging operations. Implementation of Alternative J would establish 5 new interpretive services viewpoints and 1 new interpretive trail.

ROS Inventory--Alternative J proposes to salvage 1,235 acres of timber within 1/4-mile of these primary access roads: Wellamotkin Drive (46), Cold Spring Ridge Road (4680), Deadhorse Ridge Road (4600760), and Cemetery Ridge Road (4600780). Within 1/2-mile of these roads, timber on 2,472 acres would be salvaged. Most of this salvage would be in the Roaded Natural ROS class.

Salvage activities would influence the setting of many dispersed campsites along these roads. Campers and hunters could expect to see stumps, slash, and disturbed soil in the vicinity of the salvage units. All recreationists could expect to encounter logging traffic on the roads and to hear chainsaws and logging machinery in the salvage units. Effects associated with salvage harvest are described under "Effects Common to Alternatives G, H, and J". The following paragraphs describe the acreage and logging systems associated with these recreation access roads. The salvage planned in these areas is consistent with the setting criteria for the Roaded Natural ROS class, and meets the direction provided in the CMP.

In the 1/4-mile corridors, tractor logging is prescribed for 895 acres, cable logging for 67 acres, and helicopter logging for 273 acres. In the 1/2-mile corridors, tractor logging is prescribed for 1,604 acres, cable logging for 150 acres, and helicopter logging for 718 acres.

Tractor logging would be heaviest along Wellamotkin Drive where 28 salvage units (534 acres) lay within one quarter mile of the road. Many of these salvage units border or contain dispersed campsites. The Fairchild Point, Cottonwood Creek, Cold Spring Junction, Deadhorse Junction, and several of the 46 Corridor hunting camps would be the most directly affected.

On the Cold Spring Ridge Road, 9 salvage units (198 acres) lay within 1/4-mile of the road. On the Deadhorse Ridge Road, 6 salvage units (115 acres) lay within the 1/4-mile corridor, and on the Cemetery Ridge Road, 1 salvage unit (16 acres) is within 1/4-mile of the road.

The two major sites that would be affected are the Cold Spring Ridge and Buckhorn Ridge hunter camps. However, many of these salvage units border or contain other dispersed hunter camps on these road corridors.

Most cable and helicopter logging associated with these roads would occur along Wellamotkin Drive, Cold Spring Ridge Road, and Deadhorse Ridge Road. This logging would be in areas inaccessible to tractors and well away from dispersed campsites. The effect of this salvage on recreation would be manifested primarily through increased logging traffic on the road system. No known campsites would be affected.

In the Roaded Natural ROS class, 3.9 miles of permanent roads and 1.3 miles of temporary roads would be constructed. Because these roads would be used only for timber salvage operations and would be closed following the salvage, they would have inconsequential effect on recreation settings and use patterns.

Closed roads include the northernmost segment (2.1 miles) of Cemetery Ridge Road (4600780), the northernmost segment (1.2 miles) of Deadhorse Ridge Road (4600760), and the entire length of Wildhorse Ridge Road (4600596). The closures on Cemetery Ridge and Deadhorse Ridge would be permanent, but the Wildhorse Ridge closure would be in effect only until wildlife cover becomes established (approximately 20 years). The Cemetery Ridge closure would also permanently close the Eureka Creek Trail (1732) to motorized vehicles. The permanent closures would reduce motorized use and road density within the area, and would help prevent recreation/wildlife conflicts in the DR/NV allocation. These road closures would also require that Cemetery Ridge, Eureka Creek, and Deadhorse Ridge trailheads be relocated. The relocations and their expected effects are described below. For further details on the status of roads in the project area, reviewers can consult Appendix K.

Activities and Use--In addition to the effects on recreation activities and use described under "Effects Common to All Alternatives", Alternative J would further displace visitors and influence use patterns. Visitors seeking campsites would probably avoid the areas near salvage operations. Some visitors would choose not to camp anywhere in the project area because of the traffic and noise generated by logging operations.

Areas, roads, and/or trails closed by logging contractors would also limit access to and use of those portions of the project area. These closures would limit day hiking, backpacking, horsepacking, and mountain biking opportunities. Because most of the primary access roads would remain open, sightseeing would be less impacted. Some sightseers would probably be interested in viewing parts of the salvage operation as well as the effects of the fire.

Hunting is the activity which would be most negatively affected by salvage. Since most of the logging is planned in heavily hunted areas, game could be scarce and hunter success low. Mitigation measures would reduce conflict between hunting and logging during the heaviest use days. For example, all salvage operations would be prohibited during the two days before and after opening day of buck deer and bull elk seasons.

Salvage activity would have little effect on winter use. Snowmobiling would continue near its present level, and plowed roads could encourage some cross-country skiing use in the area.

The effects described above would be temporary, lasting only through the salvage period. For a more detailed description of existing activities and use, reviewers can consult the Recreation Resources section of Chapter III.

Dispersed Campsites--In the vicinity of the following campsites, areas where firelines were constructed and soil was displaced by tractor operations would be returned to their natural repose. Access routes would be cleared of fallen trees, and the fuelwood would be left at the campsites for recreational use. High risk hazard trees on sites in the DR/TM allocation would be salvaged, and high risk hazard trees on sites in other resource allocations would be felled for recreation firewood. Burned sites would be seeded or planted with indigenous species, as necessary, to prevent resource deterioration. The recovery of all campsites would be completed within 2 years. These campsites are displayed on the Resource Recovery map for Alternative J. The total estimated cost of recovering all sites is $16,600.

Buckhorn Spring Campground
Buckhorn Ridge Hunter Camp
Cherry Creek Hunter Camp
Cold Spring Junction Hunter Camp
Cold Spring Ridge Hunter Camp
Cottonwood Creek Hunter Camp
Deadhorse Junction Hunter Camp
Deadhorse Ridge Hunter Camp
Downey Saddle Hunter Camp
Fairchild Point Hunter Camp
Five Points Creek Hunter Camp
Wildhorse Ridge Hunter Camp
Road 46 Corridor Hunting Camps
Road 4680 Corridor Hunting Camps
Road 4600760 Corridor Hunting Camps
Road 4600596 Corridor Hunting Camps

Water Sources--Eight water sources are near dispersed campsites within the project area. In the vicinity of the water sources listed below, areas where firelines were constructed and where soil was displaced by tractor operations would be returned to their natural repose. Access routes would be cleared for foot traffic. Spring boxes and exclosures would be reconstructed, and runoff ponds would be cleared of burned debris. High risk hazard trees on sites in the DR/TM allocation would be salvaged, and high risk hazard trees on sites in other resource allocations would be cleared as they fall. Burned sites would be seeded or planted, as necessary, to prevent resource deterioration. The recovery of all water sources would be completed within 2 years. These water sources are displayed on the Resource Recovery map for Alternative J. The total estimated cost of recovering all sites is $10,200.

Box Spring
Buckhorn Spring
Cottonwood Spring
Deadhorse Spring
Downey Spring
Fairchild Spring
Frog Pond
Old Cold Spring

Trailheads--Eleven trailheads are within the project area. In the vicinity of the following trailheads, areas where firelines were constructed and where soil was displaced by tractor operations would be returned to their natural repose. Burned sites would be seeded or planted, as necessary, to prevent resource deterioration. The total estimated cost of recovering all sites is $4,600.

Cemetery Ridge Trailhead	1731
Chalk Creek Trailhead	1702
Cherry Creek Trailhead	1705
Cook Creek Trailhead	1697
Cottonwood Creek Trailhead	1696
Deadhorse Creek Trailhead	1708
Dry Creek Trailhead	1704
Eureka Creek Trailhead	1732
Five Points Trailhead	1697A
Imnaha Breaks Trailhead	1713.1
Old Man Creek Trailhead	1719

Three trailheads would be relocated, and eight trailheads would be consolidated into four sites. This would improve access, expand parking, screen the sites from travel corridors, reduce conflicts with range resources, enhance public safety, and increase the efficiency of administration and maintenance. The sites would be cleared for parking and access, and high risk hazard trees would be removed. Signing, hitchracks, and stock ramps would be provided. Previous sites would be cleaned-up, and all burned facilities would be removed. All relocation and consolidation would be accomplished within 3 years. The new sites would provide permanent access to trails. For specific locations and site prescriptions for trailheads, reviewers can consult Appendix H and the Resource Recovery map for Alternative J. The estimated cost of relocating, consolidating, and and constructing associated facilities is $19,500.

The following trailheads would be relocated:

Cottonwood Creek Trailhead	1696
Five Points Creek Trailhead	1697A
Imnaha Breaks Trailhead	1713.1

The Cottonwood Creek Trailhead is accessed by Road 4600670. A portion of this road is over a north aspect, and retains mud and snow after other portions of the road have dried. There is no designated parking area near the trailhead; vehicles must be parked along the road. There are no facilities on-site, and signing is inadequate. Vegetation around the trailhead sustained heavy damage during the fire, diminishing the appeal of the setting.

The Cottonwood drainage was highlighted in a recently published hiking guide, and use will probably increase in the area. Relocation to a site which is not on a north aspect would provide convenient and safe access to the trail during the spring and fall. The new site would provide adequate parking and screening from the road. Improved signing and simple livestock facilities would be provided. A 0.2-mile trail would connect the new site with the existing Cottonwood Creek Trail.

The Five Points Creek Trailhead is accessed by Road 4680. Access is adequate, but vehicles must be parked adjacent to the road. No screening or facilities exist, signing is inadequate, and the trail is difficult to find. The Five Points drainage was also highlighted in the hiking guide.

The new trailhead site would provide adequate parking and screening from the road. Signing and livestock facilities would be installed. Water for livestock is already available. This site also provides visitors with a dramatic view of the drainages east of Cold Spring Ridge. There would be opportunities to provide services for interpreting the role of fire and fire management in the NRA. A 0.3-mile trail would connect the new site with the existing Five Points Creek Trail.

The Imnaha Breaks Trailhead is accessed by Road 4600788. Access is adequate, but no screening exists. No facilities are available, and parking is very limited.

A bench above the road would provide the trailhead adequate screening from the road and parking area. Signing and livestock facilities would be provided, and a 0.2-mile trail would connect the new site with the existing Imnaha Breaks Trail.

The following trailheads would be consolidated:

Cemetery/Eureka Trailheads	1731/1732
Cherry/Chalk Trailheads	1705/1702
Cook/Old Man Trailheads	1697/1719
Dry/Deadhorse Trailheads	1704/1708

The Cemetery Creek and Eureka Creek Trailheads are accessed by Road 4600780. Because the northernmost segment (2.1 miles) of this road is closed under all of the action alternatives, relocating these trailheads is necessary for vehicle access.

The two trailheads would be consolidated at a site located just south of the boundary between the DR/NV and DR/TM allocations where the road closure begins. The road to this site would be improved, and the site would provide adequate space for parking and facilities. At the new site there would be opportunities for providing services to interpret fire management within the NRA, as well as its cultural history and plant communities.

The Cherry Creek and Chalk Creek Trailheads are currently located at the Cherry Creek Ranch. They are accessed by Road 4600788. During the spring and fall months the last 1 mile segment of access is restricted to 4-wheel-drive vehicles, and is periodically restricted during all seasons by a locked gate. Visitor parking occasionally conflicts with range permittee operations and administrative field activities. The fire burned intensely through the Cherry Creek Ranch, creating hazards in accessing the trail.

The two trailheads would be consolidated at another site, to circumvent the gate and to avoid conflict with range and administrative uses. This site would provide adequate parking, facilities, and water. The site would provide access to an existing 0.5-mile trail along Cherry Creek which intersects the Cherry Creek and Chalk Creek trails. The new trailhead would offer many improvements in visitor access to these trails.

The Cook Creek and Old Man Creek Trailheads are accessed by Road 4600760. Because the northernmost segment (1.2 miles) of this road is closed under all of the action alternatives, relocating the Old Man Creek Trailhead is necessary to provide vehicle access.

The two trailheads would be consolidated at one site, just south of the boundary between the DR/NV and DR/TM allocations where the road closure begins. This location is very close to the present Cook Creek Trailhead. The road to this site would be improved, and the site would provide adequate space for parking and facilities. At the new site there would be opportunities to provide services for interpreting the role of fire and fire management in the NRA.

The Dry Creek and Deadhorse Creek Trailheads are accessed by Road 4680. Access to the Dry Creek Trailhead is adequate, but not to the Deadhorse Trailhead. The latter is located at the Cold Spring Cow Camp where access is blocked by a locked gate 0.8 miles above the trailhead on Road 4680150. The fire burned intensely through the cow camp, and the site should be avoided by recreationists. No trailhead facilities exist at either site.

The two trailheads would be consolidated at another site, located 0.2 miles south of the present Dry Creek site on the west side of Road 4680. This location would improve access and reduce conflicts with range permittee operations. It would provide adequate parking and screening from the road. Signing and livestock facilities would be installed. Water for livestock is already available. This site would provide a scenic viewpoint and excellent opportunities for providing interpretive services.

Trails--The existing trail system within the project area, totaling 57.8 miles, would be maintained for recreational access. Each trail would be cleared of hazards and burned debris and upgraded to a level consistent with current management objectives. Each trail would be cleared of hazards and burned debris. Normal maintenance would be performed over 13.0 miles, and more intensive maintenance would be required to clear an additional 29.6 miles. Additional reconstruction of 13.2 miles of disrupted segments would bring the trail system to a level consistent with current management objectives.

High risk hazard trees along trail corridors would be felled for public safety. Preliminary reconnaissance estimates the average number of hazard trees along trail corridors in the lightly burned areas be 5 trees per mile. Along the moderately burned trail corridors the average is 15 hazard trees per mile. Along heavily burned corridors hazard trees average 30 per mile.

This maintenance would result in a substantial improvement over the pre-fire condition of the trail system. It would require an initial investment of approximately $308,800 above the minimum level of recovery proposed under Alternative G, and would require approximately 5 years to accomplish. The following trails, displayed on the Resource Recovery map for Alternative J, would be included. Reviewers can consult the Recreation Feature Prescriptions in Appendix H for maintenance details.

Cemetery Ridge Trail	1731
Chalk Creek Trail	1702
Cherry Creek Trail	1705
Cook Creek Trail	1697
Cottonwood Creek Trail	1696
Deadhorse Creek Trail	1708
Dry Creek Trail	1704
Eureka Creek Trail	1732
Five Points Creek Trail	1697A
Imnaha Breaks Trail	1713.1
Old Man Creek Trail	1719

Interpretive Sites--Five sites would be constructed to provide interpretive services facilities for describing the role of fire and fire management, and the history and ecology of the project area. Display design would be simple, rustic, and complementary with ROS setting criteria. Site access would be by road or trail, and views from these sites would be among the most scenic in the project area. They would be developed within 3 years and would be maintained as permanent facilities. For further information regarding the specific locations and site prescriptions for each of these sites, reviewers can consult Appendix H and the Resource Recovery map for Alternative J. The estimated cost of establishing these sites is $5,400.

Cemetery Ridge Lookout
Cold Spring Ridge/Cook Creek Viewpoint
Deadhorse Ridge Viewpoint
Fairchild Point Lookout
Frog Pond

Magnificent landscapes involve visitors in the natural processes which have sculpted geologic wonders.

Summary of Action Alternatives

This section is intended to summarize for the reviewer the advantages and disadvantages of the action alternatives, and to summarize their respective effects on recreation resources.

Implementation of Alternatives G, H, I, and J would provide a complete recovery of recreation resources to their pre-fire condition. All fire suppression impacts would be mitigated. Burned debris would be removed from recreation sites, water sources, and trails, where appropriate. However, only Alternatives H, I, and J would improve any recreation sites to a standard beyond their pre-fire condition.

Alternatives G, H, and J propose varying levels of timber salvage. Alternative G salvages the most; Alternative H salvages the least. But neither Alternative G or H would provide no-cut buffers on salvage units that contain or border recreation sites and visual foregrounds. This situation occurs at several hunter camps, trailheads, and water sources and along Wellamotkin Drive (Road 46), Cold Spring Ridge (Road 4680),Wellamotkin Drive (Road 46), Cold Spring Ridge (Road 4680), Cemetery Ridge (Road 4600780), and Deadhorse Ridge (Road 4600760). Only Alternative J completely buffers recreation sites and visual foregrounds from the effects of the salvage.

Alternative I proposes the maximum benefit to recreation resources. A variety of facilities would be provided at trailheads, all trails would be intensively maintained, and several interpretive features would be developed.

Alternative J provides a balance of recreation resource recovery with the least cost investment. All damaged sites, trails, and facilities would be returned to pre-fire condition and buffered from salvage operations. At selected sites, additional improvements including rustic signing, expanded parking, livestock facilities, and water developments would be provided within the ROS setting character of the area. Several trailheads would be relocated or consolidated to provide more accessible, attractive, and functional sites and to reduce conflicts with range operations and wildlife populations. All trails would be improved to meet current management objectives. Scenic interpretive sites would display information about the history, ecology, and management of fire in the area.

The cost of providing the recreation resources package in Alternative J would be about $238,400 above the minimum recovery costs described under Alternative G. Trail enhancement costs are estimated at $218,100. Recreation site enhancements for trailheads and interpretive viewpoints are estimated at $20,300. Without the emphasis on trail enhancement, however, the cost decreases substantially, and this recreation package could be provided for only about $20,300 above the minimum recovery costs described in Alternative G.

IRREVERSIBLE AND IRRETRIEVABLE ENVIRONMENTAL EFFECTS

No irreversible commitment of resources has been identified.

Recreation developments proposed by the various alternatives would require minor irretrievable resource commitments at several sites throughout the project area. These sites include dispersed campsites, water sources, interpretive viewpoints, trailheads, and trails. At these sites, the potential timber and forage production would be foregone in providing recreation opportunities associated with campsites, trailheads, trails and interpretive sites. For the specific location of each site, reviewers should consult Appendix H.

PROBABLY UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

Recreationists would be subject to increased hazards at campsites and along trails and roads. These hazards would include falling trees and unstable trail segments. The hazards would progressively decrease as hazard trees are removed and trails are maintained. The adverse effect would diminish within 5 years for tread segments and within 20 years for falling trees.

SHORT-TERM USE VERSUS LONG-TERM PRODUCTIVITY

No effects between short-term use and long-term productivity have been identified.

ENVIRONMENTAL EFFECTS UNCHANGED BY ALTERNATIVES

Certain recreational activities would increase because of the fire. Mushroom gathering would show the largest increase because of the production and desirability of morels. Sightseeing and day hiking would show moderate increases because people are curious about the effects of the fire and the scope of the recovery. These effects would be negligible within 3 years.

The density of green trees which surround recreation sites would be decreased because of mortality. Some of these dead trees have already fallen, but some would continue standing for several years, depending on the condition of the tree and the environmental stresses to which they are subjected. The effect would be reconciled in approximately 20 years as new vegetation develops at these recreation sites.

VISUAL RESOURCE

INTRODUCTION

The Tepee Butte Fire introduced additional variety and diversity to the vegetative character of the project area. The overall visual patterns created by the fire are natural appearing due to the interaction of fire, topography, and existing vegetative patterns. This forms the base or characteristic landscape against which the effects of implementing any of the action alternatives on the visual resource can be compared.

The consequences of these effects are presented in the eight sections which follow. The first section, **Important Interactions**, considers the combined effects of the fire and the implementation of alternatives on the visual resource. The section on **Cumulative Effects (Maximum Disturbance)** explains how these effects are measured and analyzed. The next five sections directly address the consequences of each alternative on the visual resource. These sections are followed by a summary that applies to all action alternatives. Other concerns, identified in the National Environmental Policy Act (NEPA), are addressed in the final section.

The reviewer is encouraged to read the Visual Resource section of Chapter III, as well as Appendix C, which describe in detail the analysis process used to assess cumulative effects on the resource.

IMPORTANT INTERACTIONS

Initially, the approach considered for general visual analysis was that the fire was an intrusion into the character of the landscape. This approach would consider the effects of fire as negative and then rehabilitate affected resources with salvage activities. The second approach was developed after discussions were held with one of the Regional Landscape Architects, and three other Forest Landscape Architects, concerning the role of fire in a forest setting.

Consensus among these professionals suggested that the landscape which has been affected by fire is natural appearing and its aesthetic integrity is intact. From this perspective, the effects of fire can generally be considered as more positive than negative. Due to the fact that varying sizes and intensities of burned areas are intermingled with green, unburned areas, visual variety is introduced to the characteristic landscape. There are no panoramically blackened landscapes in the project area. The effect of the fire is negative only in the sense that some management options may be foregone until vegetative screening returns and other natural recovery processes have visibly begun.

Impacts to the visual resource vary through the range of alternatives. Site-disturbing management activities which affect the visual resource are primarily those associated with timber harvest: road and landing construction, logging slash and stumps, and corridors created during cable logging. These effects are expressed as contrasts in form, line, color, and texture between the management activity and those of the natural landscape.

The range of visual effects generated by harvest activities will vary in intensity and duration, according to the logging system(s) used during salvage. Three systems have been proposed under the action alternatives: 1) Helicopter, 2) Skyline Cable, and 3) Tractor. The location, type of system, and extent of use prescribed under each of the alternatives are described in Chapter II and Appendix K of this document.

Helicopter systems provide land managers with the greatest opportunity to manipulate harvest operations to blend activities' effects with the surrounding landscape. Trees can be harvested selectively by helicopter. Unit size and shape can be varied in great detail. Salvage areas can be designed to appear more natural after harvest. Long-term evidence of salvage is reduced by helicopter logging, because disturbance to soils and the remaining vegetation is minimal. The need for road construction is greatly reduced, since access is not required for all units. However, landings are usually larger and must be located central to salvage operations.

Skyline cable systems provide limited opportunities for managers to blend salvage units into the characteristic landscape. Opportunities to reduce visual impacts are limited too, because cutting-unit boundaries are necessarily more defined. Unit shapes tend to be more geometric when a skyline system is used. Soil disturbance is greater and remains evident longer. Skyline corridors used for yarding logs to the landing will create visible lines that will be evident due to disturbance of soil and vegetation. Landings will also be evident where skyline corridors converge. Generally, at least one landing is required for each unit. Roads are required to access units, and are generally located across midslope areas or on ridgetops. These roads will be evident for a long time.

Tractor systems are used in areas where slopes are moderate. Compaction from the treads of the machine, and from the yarding of logs, significantly impacts the landscape. Soil disturbance is greatest when this system is used. Unit size and shape can be manipulated to blend with the landscape, but tend to remain evident longer due to skid trails used for yarding, the number of landings used, and the roads required to access them.

Effects of salvage logging are most evident in the reduction or removal of vegetative cover. Contrast in the texture of the vegetative canopy and of surrounding soils (in burned or green stands) is greatest when harvest is accomplished with silvicultural clearcuts. Contrast is less evident when harvest is accomplished with partial-cuts and when some vegetation is retained after harvest.

Direction provided by the Comprehensive Management Plan (CMP) for timber harvest activity, including the 2-acre Maximum Opening criterion, specifies that there shall be no even-aged management through regeneration clearcuts. Any salvage harvest would therefore be accomplished through partial-cut methods. Each harvest unit prescribed under each alternative has been analyzed with the aid of a computer to determine, given its stand condition (including its green/black ratio and size class distributions), whether it will create openings larger than 2 acres. If a given unit's green component, together with its unharvested, unmerchantable black component do not meet the 2-acre criterion, then the prescription is adjusted to leave enough merchantable black volume unharvested to meet the criterion.

Reforestation with young conifers will mitigate vegetation removal (salvage) in 5-10 years. However, complete recovery in the context of visual resource management is not expected for about 20 years, or until planted trees reach a height of about 20'. Natural recovery of grasses and shrubs is already occurring, and will require a shorter time (1-4 years) to provide some visible evidence of recovery. However, natural recovery could be delayed 2-4 years by the destruction of native plant species during salvage activities. Natural revegetation in the earliest phases of recovery will begin with the appearance of grasses, forbs, and shrubs. These pioneer species will restore the landscape to its "natural" colors. Later, larger hardwoods and conifers will return, but this may be slower than in areas which are hand-planted. The type and density of vegetation will vary according to site, topography, and fire intensity.

Visual Quality Objectives (VQOs) (see Chapter III) have been established as criteria for determining the amount of alteration any portion of Hells Canyon NRA could sustain without jeopardizing its visual quality. The Tepee Butte Project timber salvage area would involve two of the five VQOs identified for the NRA.

To be in compliance with the VQOs, management activities are designed to visually harmonize with the landscape and to maintain a natural appearance in the project area. Several methods are commonly used to reduce or mitigate the visual effect of management activities, including harvest unit design, road construction design, and treatment of forest residue. The use of irregular boundaries in designing harvest units would avoid artificial straight lines in the forest setting. The effects of harvest can be mitigated to a lesser degree by leaving trees on unsuitable lands, in riparian areas, and in special wildlife areas. The number of trees proposed to be left in these areas varies by alternative.

Avoidance of midslope road construction (wherever possible) will avert strong contrasts of line and color with the natural landscape. Where construction is performed in these areas, roads will closely follow topographic features. Lower standards of road design will minimize the cuts and fills on traversed slopes. Within foreground areas, increased removal or cleanup of residue from harvest activities can restore a more natural appearance to harvested areas. A series of photo points established at panoramic viewpoints will allow short- and long-term monitoring of the effectiveness of visual mitigation as well as the visual recovery of the fire area.

CUMULATIVE EFFECTS (MAXIMUM DISTURBANCE)

The visual concept of "disturbance-at-one-time" addresses the cumulative effects of management activities (usually timber harvest) occurring in each viewshed in a given time period. Each harvest unit may individually meet the Visual Quality Objective (VQO) assigned to the area where the harvest occurred. As a group, however, harvest units may disturb or change too much of the natural landscape at once, and exceed the spatial (distribution) limitations of the viewshed.

Twenty years of plantation growth is usually required for a regenerated stand to recover the appearance of a continuous, textured landscape. A harvest unit is not considered visually apparent following twenty years of re-growth. The maximum disturbance-at-one-time for each VQO for each viewshed is called the Maximum Disturbance Threshold. It is 14 percent for the Partial Retention (foreground) VQO, 20 percent for Partial Retention (middleground), and 30 percent for Modification (middleground). For a more detailed description of Maximum Disturbance Thresholds, see Appendix C.

As a Maximum Disturbance Threshold is approached or exceeded, the visual condition of the viewshed is too greatly altered to be within acceptable impacts described by the VQO.

ALTERNATIVE A

Under this alternative, Forest visitors could expect views of unsalvaged, fire-affected stands of mixed-conifer tree species; deciduous shrub stands, and grassy/forb prairies and rocky openings as seen from the Snake River (foreground, midground); Wellamotkin Drive (46) and Cold Springs Road (4690) (foreground, midground); and Cottonwood Creek (1696), Cook Creek (1697), Eureka Creek (1732), Deadhorse Creek (1708) and Five Points Creek (1697a) Trails (foreground, midground).

Middleground views now appear as combinations of black openings on green and/or tan slopes, pockets of black on green and/or tan slopes, and pockets of green on black slopes, depending on the vegetation patterns and burn intensities. In approximately 4 years, as the natural successional process occurs, the black patterns will change to dark grey, to grey/green, and finally to green, as the natural vegetation becomes dominant. For some years, larger, fire-killed trees will protrude from the green shrub understory. In time, conifers will again become the predominant overstory.

Foreground views will be similar to those described for the middleground. Some visual elements are potentially positive. Snags, for example, may be seen as natural "sculptures", as well as elements of stand structure. A few large, intensely burned, black stands may negatively dominate views for the short term. In some areas, existing vegetation screens which created variety would be lost. In other areas variety would be created by the loss of screening vegetation.

No management activity is proposed under this alternative, so there would be no effects on the post-fire visual resource. However, resources which sustained negative impacts during fire suppression activities would not be rehabilitated. Fire suppression activities, including fireline construction, tree cutting, and use of staging areas and helispots, created generally light to moderate damage to vegetation and soils in the project area. Light damage will recover in two to three years with little or no assistance. Without rehabilitation though, tractor firelines on ridgetops could be evident in the landscape for several decades.

The overall visual patterns created by the fire are generally natural appearing due to the interaction of fire, topography, and existing vegetative patterns. The Visual Condition (see Chapter III) of viewsheds would remain unchanged under Alternative A.

Cumulative Effects (Maximum Disturbance)--The cumulative effects expected under Alternative A (expressed in terms of Maximum Disturbance) do not exceed or approach any disturbance thresholds, because no salvage activities would occur.

ALTERNATIVE G

With this alternative, Forest visitors could expect views of moderate amounts of stands salvaged by partial-cutting of mixed-conifer tree species; deciduous shrub stands, and grassy/forb prairies and rocky openings as seen from the Wellamotkin Drive (46) and Cold Springs Road (4690) (foreground, midground); and Cottonwood Creek (1696), Cook Creek (1697), Eureka Creek (1732), Deadhorse Creek (1708), and Five Points Creek (1697a) Trails (foreground, midground).

In foreground views from roads, the area would change from a slightly altered landscape to a moderately altered landscape, occasionally dominated by the effects of management activities. Such views would include harvest units (especially cut stumps and logging slash), and a minor amount of road construction (3.9 miles) and landings. Foreground views would be affected by 24 harvest units visible from Wellamotkin Drive (46) and the Cold Spring Road (4680). Views from other, minor roads would be less impacted, because of limited use. Foregrounds of recreation sites would not be buffered by no-cut areas. The foreground portion of the Deadhorse Creek Trail (1708) would be affected by 4 harvest units. Harvest residue which is not natural appearing may require slash treatment. In this way road and trail foreground areas could be returned to a more natural character.

In middleground views, the area would change from a slightly altered landscape to a moderately altered landscape, occasionally dominated by management activity. Effects would include size, quantity, and density of removed vegetation (contrasting textures) within salvage harvest units. Short lengths of roads and portions of landings would be visible. Revegetation of cut and fill slopes would reduce the visual impact of color and line contrasts which result from road and landing construction.

Due to the moderate amount of harvest activity and associated road development proposed under this alternative, the Visual Condition would be Moderately Altered in the Wellamotkin viewshed. Other viewsheds would remain Natural Appearing.

Cumulative Effects (Maximum Disturbance)--Alternative G cumulative effects (expressed in terms of Maximum Disturbance) are shown in Figure IV-1 . Maximum Disturbance Thresholds are exceeded in the Partial Retention (foreground) VQOs in the Cottonwood Creek Viewshed, and in the Wellamotkin Viewshed. All other viewsheds are under all VQO Maximum Disturbance Thresholds.

Figure IV-1 Visual Cumulative Effects - Alternative G

Cottonwood Creek	Cold Springs Creek	Wellamotkin	Cook Creek	Cherry Creek	Scenic Snake
PR(fg) 867 VDI: L M H 10 167 53 w/a 27% w/a MDT 21%	PR(fg) 2386 VDI: L M H 26 100 0 w/a 5% w/a MDT 22%	**PR(fg) 4567 VDI: L M H 119 707 184 w/a 22% w/a MDT 21%**	PR(fg) 699 VDI: L M H 0 51 0 w/a 7% w/a MDT 22%	PR(fg) 0 VDI: L M H 0 0 0 w/a 0.0% w/a MDT 0%	PR(fg) -- VDI: L M H -- -- -- w/a --% w/a MDT --%
PR(mg) 8947 VDI: L M H 104 603 24 w/a 8% w/a MDT 40%	PR(mg) 2743 VDI: L M H 32 4 0 w/a 1% w/a MDT 43%	PR(mg) 281 VDI: L M H 0 12 8 w/a 7% w/a MDT 39%	PR(mg) 17962 VDI: L M H 18 7 0 w/a 0.1% w/a MDT 42%	PR(mg) 13183 VDI: L M H 38 15 10 w/a 0.5% w/a MDT 41%	PR(mg) --- VDI: L M H -- -- -- w/a --% w/a MDT --%
M(mg) 3050 VDI: L M H 72 610 124 w/a 26% w/a MDT 50%	M(mg) 929 VDI: L M H 0 0 0 w/a 0.0% w/a MDT 46%	M(mg) 581 VDI: L M H 30 129 21 w/a 31% w/a MDT 50%	M(mg) 480 VDI: L M H 7 31 0 w/a 8% w/a MDT 51%	M(mg) 1347 VDI: L M H 91 74 21 w/a 14% w/a MDT 52%	M(mg) -- VDI: L M H -- -- -- w/a --% w/a MDT --%

Inventoried Acres
PR(fg) - Partial Retention (foreground)
PR(mg) - Partial Retention (middleground)
M(mg) - Modification (middleground)

L - Low
M - Mod.
H - High

VDI - Visual Disturbance Impacts

MDT - Maximum Disturbance Threshold

w/a - Weighted Average

Grey toned areas indicate Thresholds approached or exceeded

Alternative H

Under this alternative, Forest visitors could expect views of minor amounts of stands salvaged by partial-cutting of mixed-conifer tree species; deciduous shrub stands, and grassy/forb prairies and rocky openings as seen from the Wellamotkin Drive (46) and Cold Springs Road (4690) (foreground, midground); and Cottonwood Creek (1696), Cook Creek (1697), Eureka Creek (1732), Deadhorse Creek (1708) and Five Points Creek (1697a) Trails (foreground, midground).

In foreground views from roads, the area would remain a slightly altered landscape, occasionally dominated by the effects of management activities. Such views would include harvest units (especially cut stumps and logging slash), and a minor amount of road construction (2.7 miles) and landings. Foreground views would be affected by 7 harvest units, visible from Wellamotkin Drive (46) and the Cold Spring Road (4680). Views from other, minor roads would be less impacted because of the roads' limited use. Foregrounds of recreation sites would not be buffered by no-cut areas. The foreground portion of Deadhorse Creek Trail (1708) would be affected by a view of 2 harvest units. Harvest residue which is not natural appearing may require slash treatment. In this way, the road and trail foreground areas could be returned to a more natural character.

In middleground views, the area would remain a slightly altered landscape, occasionally dominated by management activity. Effects would be evidenced by the size, quantity, and density of removed vegetation (contrasting textures) within salvage harvest units. Very small lengths of roads or portions of landings would be visible. Revegetation of cut and fill slopes would reduce the visual impact of color and line contrasts which result from road and landing construction.

Due to the minor amount of harvest activity and associated road development proposed under this alternative, the Visual Condition would remain Slightly Altered in the Wellamotkin viewshed. Other viewsheds would remain Natural Appearing.

Cumulative Effects (Maximum Disturbance)--The cumulative effects expected under Alternative H (expressed in terms of Maximum Disturbance) are shown Figure IV-2. All viewsheds would remain under all Visual Quality Objectives' Maximum Disturbance Thresholds.

Figure IV-2. Visual Cumulative Effects - Alternative H

Cottonwood Creek	Cold Springs Creek	Wellamotkin	Cook Creek	Cherry Creek	Scenic Snake
PR(fg) 867 VDI: L M H 10 48 14 w/a 8% w/a MDT 21%	PR(fg) 2386 VDI: L M H 23 40 0 w/a 3% w/a MDT 23%	PR(fg) 4567 VDI: L M H 92 102 59 w/a 6% w/a MDT 21%	PR(fg) 699 VDI: L M H 0 8 0 w/a 1% w/a MDT 22%	PR(fg) 0 VDI: L M H 0 0 0 w/a 0.0% w/a MDT 0%	PR(fg) -- VDI: L M H -- -- -- w/a --% w/a MDT --%
PR(mg) 8947 VDI: L M H 39 189 115 w/a 4% w/a MDT 39%	PR(mg) 2743 VDI: L M H 29 0 0 w/a 1% w/a MDT 43%	PR(mg) 281 VDI: L M H 0 5 0 w/a 2% w/a MDT 40%	PR(mg) 17962 VDI: L M H 18 0 0 w/a 0.1% w/a MDT 43%	PR(mg) 13183 VDI: L M H 0 0 0 w/a 0.0% w/a MDT 37%	PR(mg) --- VDI: L M H -- -- -- w/a --% w/a MDT --%
M(mg) 3050 VDI: L M H 18 195 142 w/a 12% w/a MDT 49%	M(mg) 929 VDI: L M H 0 0 0 w/a 0.0% w/a MDT 46%	M(mg) 581 VDI: L M H 16 25 8 w/a 8% w/a MDT 51%	M(mg) 480 VDI: L M H 5 0 0 w/a 1% w/a MDT 54%	M(mg) 1347 VDI: L M H 38 0 0 w/a 3% w/a MDT 54%	M(mg) -- VDI: L M H -- -- -- w/a --% w/a MDT --%

Inventoried Acres
PR(fg) - Partial Retention (foreground)
PR(mg) - Partial Retention (middleground)
M(mg) - Modification (middleground)

L - Low
M - Mod.
H - High

VDI - Visual Disturbance Impacts

MDT - Maximum Disturbance Threshold

w/a - Weighted Average

Grey toned areas indicate Thresholds approached or exceeded

ALTERNATIVE I

Under this alternative, Forest visitors could expect views of unsalvaged, fire-affected stands of mixed-conifer tree species; deciduous shrub stands, and grassy/forb prairies and rocky openings as seen from the Snake River (foreground, midground); Wellamotkin

Drive (46) and Cold Springs Road (4690) (foreground, midground); and Cottonwood Creek (1696), Cook Creek (1697), Eureka Creek (1732), Deadhorse Creek (1708) and Five Points Creek (1697a) Trails (foreground, midground).

Middleground views now appear as combinations of black openings on green and/or tan slopes, pockets of black on green and/or tan slopes, and pockets of green on black slopes, depending on the vegetation patterns and burn intensities. In approximately 4 years, as the natural successional process occurs, the black patterns would change to dark grey, to grey/green, and finally to green, as the natural vegetation becomes dominant. For some years, larger, fire-killed trees will protrude from the green shrub understory. In time, conifers will again become the predominant overstory.

Foreground views will be similar to those described for the middleground. Some visual elements are potentially positive. Snags, for example, may be seen as natural "sculptures", as well as elements of stand structure. A few large, intensely burned, black stands may negatively dominate views for the short term. In some areas, existing vegetation screens which created variety would be lost; in other areas variety would be created by the loss of screening vegetation.

Management activities proposed under this alternative include the planting of intensely burned (> 50 percent mortality) foreground areas of Wellamotkin Drive (46) and Cold Spring Road (4680). Ponderosa pine and western larch would be hand-planted, to enhance the visual variety and stand structure of these foregrounds, and to control what species will return and where they will return. Planting selected recreation site foregrounds (camps, viewpoints, springs, etc.) with indigenous shrub and hardwood species is also proposed. Variety would be enhanced by adding color (aspen, redstem ceanothus, wildflower mix); providing spring bloom (oregon grape, spirea); and encouraging wildlife use (serviceberry, willow, huckleberry).

Recreation developments proposed under this alternative would be designed to avoid negative effects on visual resources. Resources impacted by fire suppression activities would be rehabilitated.

Visual patterns created by the fire are generally natural appearing. Under Alternative I the Visual Condition of viewsheds would remain unchanged.

Cumulative Effects (Maximum Disturbance)--The cumulative effects expected under Alternative I (in terms of Maximum Disturbance) do not exceed thresholds because there would be no salvage.

ALTERNATIVE J

Under this alternative, Forest visitors could expect views of moderate amounts of stands salvaged by partial-cutting of mixed-conifer tree species; deciduous shrub stands, and grassy/forb prairies and rocky openings as seen from the Wellamotkin Drive (46) and Cold Springs Road (4690) (foreground, midground); and Cottonwood Creek (1696), Cook Creek (1697), Eureka Creek (1732), Deadhorse Creek (1708) and Five Points Creek (1697a) Trails (foreground, midground).

In foreground views from roads, the area will remain slightly altered by the effects of human activities, including harvest units (especially cut stumps and logging slash). A minor amount of road construction (3.9 miles) and landings would be screened from view by 300' no-cut buffers adjacent to 24 cutting-units. These units would be located in the foreground of Wellamotkin Drive (46) and Cold Springs Road (4680). Foregrounds of Recreation sites will have variable no-cut buffers. Foreground portions of trails affected by harvest units would include the Deadhorse Creek Trail (1708), with 4 units. Harvest residue which is not natural appearing may need slash treatment to help return the trail foreground area to a more natural character.

In middleground views, the area will change from a slightly altered landscape to a moderately altered landscape, occasionally dominated by management activity. Effects include size, quantity and density of removed vegetation (contrasting textures) within salvage harvest units. Portions of roads or landings would be visible. Revegetation of cut and fill slopes would reduce the visual impact of color and line contrasts which result from road and landing construction.

Due to the moderate amount of harvest activity and associated road development proposed under this alternative, the Visual Condition would be Moderately Altered in the Wellamotkin viewshed. Other viewsheds would remain Natural Appearing.

Cumulative Effects (Maximum Disturbance)--The cumulative effects expected under Alternative J (expressed in terms of Maximum Disturbance) are shown in Figure IV-3. In the Cottonwood Creek Viewshed the Partial Retention (foreground) VQO would be slightly exceeded. In the Wellamotkin Viewshed the Partial Retention (foreground) VQO would be approached. All other viewsheds are under all VQO Maximum Disturbance Thresholds.

Figure IV-3. Visual Cumulative Effects - Alternative J

Cottonwood Creek	Cold Springs Creek	Wellamotkin	Cook Creek	Cherry Creek	Scenic Snake
PR(fg) 867 VDI: L M H 10 119 53 w/a 21% w/a MDT 20%	PR(fg) 2386 VDI: L M H 23 65 0 w/a 4% w/a MDT 23%	PR(fg) 4567 VDI: L M H 106 595 136 w/a 18% w/a MDT 21%	PR(fg) 699 VDI: L M H 0 43 0 w/a 6% w/a MDT 22%	PR(fg) 0 VDI: L M H 0 0 0 w/a 0.0% w/a MDT 0%	PR(fg) -- VDI: L M H -- -- -- w/a --% w/a MDT --%
PR(mg) 8947 VDI: L M H 104 366 135 w/a 7% w/a MDT 40%	PR(mg) 2743 VDI: L M H 29 3 0 w/a 1% w/a MDT 43%	PR(mg) 281 VDI: L M H 0 8 9 w/a 6% w/a MDT 38%	PR(mg) 17962 VDI: L M H 18 7 0 w/a 0.1% w/a MDT 42%	PR(mg) 13183 VDI: L M H 33 9 10 w/a 0.4% w/a MDT 41%	PR(mg) -- VDI: L M H -- -- -- w/a --% w/a MDT --%
M(mg) 3050 VDI: L M H 72 422 245 w/a 24% w/a MDT 49%	M(mg) 929 VDI: L M H 0 0 0 w/a 0.0% w/a MDT 46%	M(mg) 581 VDI: L M H 28 118 23 w/a 29% w/a MDT 50%	M(mg) 480 VDI: L M H 5 31 0 w/a 8% w/a MDT 51%	M(mg) 1347 VDI: L M H 63 65 21 w/a 11% w/a MDT 51%	M(mg) -- VDI: L M H -- -- -- w/a --% w/a MDT --%

Inventoried Acres
PR(fg) - Partial Retention (foreground)
PR(mg) - Partial Retention (middleground)
M(mg) - Modification (middleground)

L - Low
M - Mod.
H - High

VDI - Visual Disturbance Impacts

MDT - Maximum Disturbance Threshold

w/a - Weighted Average

Grey toned areas indicate Thresholds approached or exceeded

SUMMARY OF ACTION ALTERNATIVES

All Action Alternatives (G,H,I,& J) will meet all VQOs and the CMP's 2-acre Maximum Opening criterion. However, there is a difference in the way the foregrounds of Wellamotkin Drive (46) and Cold Spring Road (4680) and the foregrounds of recreation sites (trailheads, hunter camps and springs) are managed under Alternatives G and J. Under Alternative G, trees in the foregrounds of salvage units will be marked to be cut. The criteria will be to partially retain the landscape's desired character of varying tree sizes (especially large tree trunks), stand structure (the "walls" of visual space); and to protect the small scale variety provided by natural shrub revegetation already in progress.

This marking process involves a judgment based also on which trees will remain alive and, therefore, a viable part of the foreground character. If trees perceived to be alive are actually dead or if they later die, there is a risk that the Partial Retention VQO will not be met. This, then, is the advantage that the no-cut buffers developed for Alternative J provide, an advantage which is not provided under Alternative G. Another advantage is that views through the no-cut buffer into the remaining salvage unit or other units beyond and their negative elements (stumps, etc.) will be mitigated by the buffer's screening affect. Alternative H is similar to Alternative G, as discussed above, but because less timber in the foreground is salvaged, the impacts are less.

Alternative I proposes no salvage, therefore no negative visual impacts would be expected. See Chapter II, Comparison of Alternatives chart. Alternative I prescribes the planting of trees and shrubs in selected foregrounds as a means of enhancing the Visual Resource.

Cumulative Effects criteria would be met under Alternatives A, H, and I. Alternatives G and J meet the Cumulative Effects criteria in all viewsheds except Cottonwood Creek and Wellamotkin, where the Partial Retention (foreground) VQO's Maximum Disturbance Thresholds are exceeded.

OTHER NEPA CONCERNS

Probable adverse environmental effects that cannot be avoided: Recreation visitors would see a modified forest in the foreground and middleground, where salvage harvest and road construction are implemented. These harvest effects would eventually be eliminated by re-growth of vegetation.

Relationship between short-term use and long-term productivity: Active management of areas in the recovery project area would result in the modification of the natural landscape over the short term. Dead and dying trees would be salvaged and the natural stand structure and variety would be altered. The long-term productivity of scenic values can be maintained if future harvest in the area is postponed for approximately 20 years. In this time, vegetation will have recovered and a continuously textured landscape would again exist.

Roads built for short-term use would be obliterated and seeded to recover a natural appearance over time. However, the road scar will persist visually for a decade or more.

Irreversible and irretrievable commitment of resources: Development of permanent transportation system roads, which is proposed under Alternatives G, H, and J, would produce irreversible and irretrievable changes in the landscape.

WATER RESOURCES

This section describes how implementation of the different alternatives would affect water resources. This discussion of water quality, water quantity and riparian vegetation describes the ecological and aesthetic effects which implementation of management alternatives would have on water resources. The physical and biological effects on water resources are the primary focus of this section. Reviewers can refer to the Fisheries section of Chapter IV for a discussion of management effects on the fisheries resources.

The environmental effects of proposed project activities are presented in seven sections.

-- **GENERAL WATERSHED INTERACTIONS**

-- **WATER QUALITY REGULATIONS**

-- **ENVIRONMENTAL ELEMENTS THAT WOULD NOT CHANGE UNDER ANY ALTERNATIVE** These are water quality parameters or Beneficial Uses that have not been changed by the fire and would not be changed under any Alternative.

-- **ADVERSE EFFECTS COMMON TO ALL ALTERNATIVES** All of the effects discussed in this section are fire-induced. No additional environmental consequences would result from implementation of any alternative. Some of the fire's effects are adverse, unavoidable and significant when the affected resource is compared with its pre-fire condition. Since project implementation would not cause additional ecological change, no significant environmental effect on water resources would be expected under any of the alternatives.

-- **ADVERSE EFFECTS SPECIFIC TO ALTERNATIVES G, H, I, and J** All of the effects discussed in this section are fire-induced. Additional adverse environmental impacts would be expected under Alternatives G, H, and J, but not under Alternative I. Some of the fire's effects are adverse, unavoidable and significant when the affected resource is compared to its pre-fire condition. However, effects of management activities proposed under Alternatives G, H, and J would not be significant.

-- **BENEFICIAL EFFECTS SPECIFIC TO ALTERNATIVES G, H, I, and J** The effects discussed in this section are the consequences that would result from implementing recovery projects to counteract adverse fire-effects.

-- **EFFECTS ON WETLANDS AND FLOODPLAINS (EO 11988 and EO 11990)** This is a summary of the environmental effects on wetlands and floodplains.

GENERAL WATERSHED INTERACTIONS

The watershed and its streams are primarily the result of interactions between climate, geological types, topography, soils and vegetation. Stream channel habitat and hillslope habitat are dynamic systems balanced by influencing variables. Disturbance of equilibrium may result in habitat change. The changed habitat will reflect a new equilibrium.

Some watershed impacts wrought by management activities can be imperceptible for a few years, becoming consequencial when large storms and floods act on altered watershed habitat variables. The resultant effects then start to reach equilibrium by further influencing stream processes, soil productivity and the biological systems which depend on streams and soil.

To assess environmental effects, it is necessary to model the "cause-effect" relationship between forest harvest practices and environmental response. While many methods of modeling this relationship have been developed, only a few provide quantitative evaluation of the impacts on large areas of the environment. In the Tepee Butte fire area, many estimates, rather than exact data, must be used to predict effects to the watershed and fisheries resource associated with the fire and project activities.

Water science specialists who are familiar with the affected area can make estimates of the effects, but some of these estimates are based on what is called "incomplete or unavailable information" by the Council on Environmental Quality (40 CFR 1502.22). If the information called "incomplete" is relevant to environmental change prediction, but is considered non-essential to a reasoned choice among alternatives, effective environmental analysis is not hindered. This is possible by choosing very specific and cautious water protection Best Management Practices (BMPs) when information is determined to be "incomplete".

WATER QUALITY REGULATIONS

These regulations are used to assess the significance of environmental effects. The Federal Water Pollution Control Act of 1972, as amended, and Clean Water Act of 1977 direct Federal Agencies to follow State laws and regulations which pertain to the beneficial uses identified by the States, as well as any additional water quality standards or rules which have been established.

Beneficial Uses

The State of Oregon has established a list of Beneficial Uses of water resources within the entire Grande Ronde River basin (OAR 340-41-722, 1986 Table 13). Water Quality Standards are applied to provide protection of these uses. From the total list, the following Beneficial Uses pertain specifically to the Tepee Butte analysis area:

*livestock watering
*salmonid fish spawning
*wildlife and hunting
*water contact recreation (very minimal)
*aesthetic quality
*anadromous fish passage
*resident fish and aquatic life
*fishing (very minimal)
*salmonid fish rearing

The water quality standards that apply to these beneficial uses within the project area are outlined below.

Water Quality Standards

The Oregon Water Quality Standards which pertain to the Tepee Butte Fire Recovery Project are found in Oregon Administrative Rules 340-41, sections 026, 722 and 725. These Standards relate to dissolved oxygen, water temperature, turbidity, deposits, requirements for the highest and best practicable control of activities that can impact water quality, and to the Anti-degradation Policy.

-- **Standards for specific water quality parameters**

Dissolved oxygen -- Dissolved oxygen concentration shall not be less than 75 percent of saturation at the seasonal low, or less than 95 percent of saturation in spawning areas during spawning, incubation, hatching and fry stages of salmonid fishes.

Temperature -- No measurable increases shall be allowed outside of the assigned mixing zone, as measured relative to a control point immediately upstream from a discharge, when stream temperatures are 68 degrees F. or greater...

Turbidity (Jackson Turbidity Units, JTU) -- No more than a 10 percent accumulative increase in natural stream turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity...

[Deposits] -- The formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry shall not be allowed.

-- **Requirement for the highest and best practicable control of activities**

When such an activity as the Tepee Butte Fire Recovery Project is proposed, the Oregon Department of Environmental Quality (DEQ) and the person(s) who conduct those activities must ensure that the highest and best practicable control of operations will be employed in order to provide for the highest possible levels of water quality.

The Oregon requirement for highest and best practicable control is:

> Notwithstanding the water quality standards (as listed above), the highest and best practicable treatment and/or control of wastes, activities, and flows shall in every case be provided so as to maintain dissolved oxygen and overall water quality at the highest possible level and water temperatures, coliform bacteria concentrations, dissolved chemical substances, toxic materials, radioactivity, turbidities, color, odor, and other deleterious factors at the lowest possible levels.

-- **Anti-degradation policy**

In addition to the Standards listed above, the Clean Water Act has directed the States to develop an anti-degradation policy to protect water quality (when it is still within the Standards). The Oregon Anti-degradation Policy is stated as:

> Existing high quality waters which exceed those levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water shall be maintained and protected unless the Environmental Quality Commission chooses, after full satisfaction of the inter-governmental coordination and public participation provisions of the continuing planning process, to lower water quality for necessary and justifiable economic or social development. The Director or his designee may allow lower water quality on a short-term basis in order to respond to emergencies or to otherwise protect public health and welfare. In no event, however, may degradation of water quality interfere with or become injurious to the beneficial uses of water within surface waters of the following areas:

(A) National Parks;
(B) National Wild and Scenic Rivers;
(C) National Wildlife Refuges;
(D) State Parks.

This policy would permit the Director to consider a temporary suspension of applicable water standards, in special situations, when water quality constituents are at levels above the basin's standards. Usually, such temporary suspensions have been granted for projects involving construction of structures such as bridges, revetments, etc. within water bodies. As explained by the standard, levels of constituents which are "injurious to the beneficial uses" in the Wild and Scenic Snake River could not be waived by the Director or the Oregon Environmental Quality Commission (OEQC).

Implementation of any of the action Alternatives will provide for meeting or exceeding water standards, therefore a suspension of the water quality standards will not be requested.

The Governor of Oregon has formally designated the U.S. Forest Service as the implementing agency for non-point source pollution control on lands under its jurisdiction (Memorandum of Understanding; ODEQ and USFS 12/1/78). That memorandum established that Forest Service watershed management practices must meet or exceed the State's Best Management Practices (BMPs). Therefore, the State and the Forest Service will work cooperatively to control non-point source pollution. Due to the ecological sensitivity (i.e., vulnerability to additional harm) of the Tepee Butte project after the fire, almost all BMPs determined to be applicable to the action Alternatives exceed the effectiveness of those specified by the Oregon Forest Practices Act. Reviewers can consult Appendix D, Best Management Practices for a full discussion of the BMPs which were used.

BMPs are mitigation measures incorporated into activity management plans for the purpose of maintaining soil and water quality. For the Tepee Butte project area, two broad types of BMPs were identified and used:

-- Those chosen for their capability to provide a high assurance of preventing *any* degradation of the water quality, within parameters identified in Oregon water quality regulations. Under this criterion, no effects are incorporated into a cumulative effects analysis. This set of BMPs would be used when information is "incomplete".

-- Those chosen for their capability to provide a high assurance of activities' *compliance* with Oregon water quality regulations. These are generally more restrictive than the BMPs described above, because fire-effects are considered. They are as safe as those BMPs specified in the Oregon Forest Practices Act. When this type of BMP was used, management effects were assessed through cumulative effects analysis. These BMPs were selected when there was "complete" modeling information.

ENVIRONMENTAL ELEMENTS THAT WOULD NOT CHANGE UNDER ANY ALTERNATIVE

These are water quality parameters or Beneficial Uses that have not been changed by the fire and would not be changed by implementation of any alternative.

Water Quality Constituents

In light of scientific research in natural environments similar to the Tepee Butte project area, the following water quality constituents will *not* be affected enough to show either adverse or beneficial effects: pH, electrical conductivity, coliform and giardia bacteria, and heavy metals. Application of fertilizers or pesticides is not presently planned anywhere near perennial streamcourses. Any alternative's implementation would cause no adverse or beneficial effects to these water quality constituents.

The quantitative values of the above parameters are in compliance with Oregon water quality Standards. Project implementation will have no adverse or beneficial effect on Beneficial Uses of streamwater.

Beneficial Uses

Beneficial Uses of project area streams were previously listed under Water Quality Regulations. From this list, the Beneficial Uses that will *not* be affected enough to result in any adverse or beneficial ecological, economic or aesthetic changes have been considered. These uses are outlined below.

Livestock Watering will not be impacted. Water will remain deep enough for livestock use, even where sediment has entered the streambed.

Neither wildlife nor hunting activities would be impacted by project implementation. As described above, stream water will remain available for wildlife use. Drinking water from streams within the project area will require no more precaution than is necessary in unburned watersheds.

Fishing is not a predominant use of streams within the project area. It is unlikely that project activities would affect the fisheries resource. Reviewers can consult the Fisheries section of Chapter IV for further discussion of fisheries.

Water Contact Recreation would not be impacted under any of the alternatives. There are no stream channel pools which are deep enough for swimming; there are very few pools as deep as 3 feet. Before the fire, stream water was too cold (about 56 to 68 degrees Fahrenheit) for comfortable water contact recreation. It is unlikely that project implementation would further affect this kind of recreational use of included streams.

Other Beneficial Uses have been or will be impaired (fish and aesthetics). These effects are discussed in the Fisheries Resource section of this chapter.

ADVERSE EFFECTS COMMON TO ALL ALTERNATIVES

All of the effects discussed in this section are fire-induced. No additional environmental consequences would result from project implementation. Some of the fire-induced effects are adverse, unavoidable and significant when the affected resource is compared to its pre-fire condition. Since project implementation would not cause any additional ecological change, no significant environmental effect on water resources is expected under any of the alternatives.

For further discussion of the methods, procedures, accuracy, and source references used in the environmental effect analysis described below, reviewers can consult the Watershed

Environmental Effects Analysis Process Paper. This document is available in the Tepee Butte project files.

Snowmelt-generated Peakflow

Under any of the action alternatives, changes in peak streamflows which are caused by rain and snowmelt (or by snowmelt alone) would not be different than those described under the No Action Alternative. Fire-induced effects will have environmental consequences. No additional environmental consequences would result from implementation of any alternative. Cumulative effects analysis indicates that implementation of any action alternative would not cause a substantial increase in snow peakflow.

Fire-induced effects--Loss of forest cover resulting from the fire will cause higher peakflows. The condition of vegetation (density and location) within previously harvested areas was considered in the peakflow prediction. The prediction values obtained are, therefore, cumulative values. (see Appendix B, Section IX)

Predicted snowmelt peakflows will be much higher, 5-29 percent during a very deep snowpack year (see Chapter III, Water Resources for additional data). These increased peakflow levels will not change more than a few percent during the 10-year watershed analysis period. Even if trees were immediately re-established in all burned areas, they would not be tall enough, nor would the stands be dense enough in 10 years to significantly change snowmelt and soil water use rates. After trees have again become naturally established within the tree-loss areas, it will be 30-50 years (depending on plant association) before snowmelt rates, soil water use, and peakflow increases return to pre-fire (almost pristine) conditions.

The direct effects of higher peakflows will be:

- erosion of streambanks which in turn will cause:
- increased channel sedimentation (this sediment increase is considered in the cumulative effects analysis for each alternative)
- undercutting of a few shrubs and trees that are close to the streambank; most will fall (see Chapter IV, Fisheries)
- loss of a minor amount of stream shade, resulting in an unmeasurable rise in stream temperature
- production of turbid water that for a few days will impair the aesthetic Beneficial Use value of the water resource (see Turbidity Changes in this section)
- some lowering of the riparian area water table (a minor change in riparian vegetation composition) will be a later, indirect effect
- some minor loss of insect and leaf and needle drop to the stream due to undercut vegetation fall-down (see Chapter IV, Fisheries)

The fire-induced environmental consequence of these individually minor effects on stream channel and riparian vegetation stability is significant when viewed as a cumulative effect. The cumulative effect impacts about 90 miles of perennial streams.

The significance of the environmental consequences on the fish-related Beneficial Uses are described in Chapter IV, Fisheries.

Management-Induced effects--Relative to the peakflow changes eventuating from the fire-induced effects, no additional significant changes would result from the implementation of any alternative. Alternative activities would not change peakflows enough to adversely affect fish habitat, aesthetic quality or other established Beneficial Uses of the water.

Peakflow values will not substantially change because no live trees would be harvested under any alternative. Whether dead or dying trees are left standing, to later fall, or are removed by salvage operations; will not have any additional peakflow consequence on stream Beneficial Use. (see Appendix B, Section IX)

Rainfall-generated Peakflow

This section is a continuation of Adverse Effects Common to All Alternatives.

Peak streamflows which are caused by rainfall and would be present if any action alternative were implemented, would not be different than peakflows expected under the No Action Alternative. BMP design is such that even during an unusually extreme rainstorm there would be no peakflows generated that would be greater than those expected under the No Action Alternative. Incorporating specific BMPs will ensure that no adverse environmental effects would result under any alternative. However, the fire will cause environmental effects. The State-designated Beneficial Uses of project area streamwater will not be affected under any alternative. Cumulative effects analysis indicates that there would be no additional effects produced by an alternative that can be added to the substantial rain peakflow changes which the fire alone will produce.

A rainfall peakflow prediction model that would accurately describe the total effects of wildfire on such a large area could not be found. However, a research study for assessing concentrated runoff input to adjacent streamcourses is available. Use of this research study in the analysis provides additional information about preventing adverse effects caused by rainfall-caused peakflow. See Appendix B, Section VIII for a discussion of how this research was incorporated into BMP design.

Fire-Induced effects--No quantitative estimate of rainfall-caused peakflows was possible for pre- and post-fire conditions without a model or field data. Because the Tepee Butte fire area watersheds had only been minimally disturbed by previous management projects before the fire, rain-caused peakflows were close to those typical in a pristine watershed. After the fire there is a very high probability that rain-caused peakflows will be much higher in some subwatersheds, relative to peakflows caused by the same intensity storm event before the fire. This condition will be substantially reduced 3-5 years after the fire, when much of the lost ground cover will have become re-established. Full recovery will be many years later, when stand density and the soil infiltration rate have recovered. In some cases, where inches of soil have been lost, this recovery will take hundreds of years.

See the preceding section for a discussion of the environmental effects of higher peakflows.

The fire-induced environmental consequence of these individually minor effects on stream channel and riparian vegetation stability is significant when viewed as a cumulative effect. The cumulative effect impacts about 90 miles of perennial streams.

The significance of the environmental consequences on the fish-related Beneficial Uses are described in Chapter IV, Fisheries.

Management-Induced effects--Relative to the peakflow changes brought about by the fire, there would be no additional changes that would be significantly different as a result of the implementation of any alternative. Alternative activities would not change peakflows enough to adversely affect fish habitat, aesthetic quality or other established Beneficial Uses of the water because of the development and application of specific BMPs in action Alternative design.

Because no adequate model for predicting rain-caused peakflow exists, very conservative and restrictive BMPs were developed. These were designed to provide no reasonable doubt as to their capability to prevent *any* change to rain peakflow brought about by implementation of any action alternative. This is relative to a peakflow that might be generated by localized site conditions in the place where the management project is to be implemented. If there is no additional peakflow contribution here, there also will be no additional contribution downstream. Therefore, even without a model, assurance is provided for not causing an environmental change in excess of what will be caused by the effects of the fire alone.

For the BMP design, a 97 percent confidence level was used for specifying that no concentrated runoff from skidtrails, primary dragtrails and roads would reach a streamcourse to become an additional contribution to the peakflow. The BMP design includes at this confidence level a provision for no peakflow change brought about by an extreme high-intensity rainstorm such as a 50-year interval event.

In order to decide which BMPs to design, the site factors that could affect rain peakflows were outlined. This procedure identified the situations that would require BMP control, as well as the vigor necessary in that control. These BMPs were then tested to see if they also met the objectives for minimizing soil loss and the even tighter criteria for minimizing movement of that soil to streamcourses. The result was a decision key for the design of various activities and alternatives.

The final set of BMPs designed and chosen are BMPs 1 (A thru G), 3F, 4A, 4B and 4L. These are described in detail in Appendix D, Best Management Practices. Each alternative has this same set of BMPs, which relate specifically to rain peakflow. No flexibility or easing of restraints could be allowed under some alternatives because without a model for downstream peakflow prediction, provision had to be made for no reasonable doubt (97 percent confidence) about action alternatives not contributing to additional peakflow volumes.

Total Annual Streamflow

This section is a continuation of Adverse Effects Common to All Alternatives.

Annual streamflow volume is predicted to be the same for all alternatives.

Total annual streamflow, including summer lowflows, will temporarily increase for at least 20 years. This is primarily due to the increase in soil moisture brought about by the reduction in forest cover which resulted from the fire. The annual increase during the first ten years will be about 10-30 percent. Since the effects of increased total annual flows will enhance the area's beneficial uses, no additional time was expended estimating this flow increase.

Water Nutrients

This section is a continuation of Adverse Effects Common to All Alternatives.

Nutrients in streamwater are chemical compounds which sustain aquatic microorganisms.

Nutrient increases that might be produced if an action alternative were implemented would not be different than those predicted under the No Action Alternative. Therefore, no BMPs are needed or could be devised to prevent or minimize impacts of action alternatives on State-designated Beneficial Uses of the project area's streamflow. There would be no additional effects produced by an action alternative.

Fire-induced effects--Research shows that the two primary chemical water nutrients of concern in a wildland environment like the Tepee Butte fire area are nitrogen and phosphorus compounds. Large amounts of nitrogen in the vegetation were vaporized and lost from the forest ecosystem during the fire. The remaining available nitrogen will either be taken up by vegetation or flushed through the soils and into the streams. Elevated concentrations of nitrates in the streams would probably be measurable for the first two or three years, until vegetation in the watersheds re-colonizes the soil profile.

An increased nutrient supply can cause a growth of microorganisms which will use, and thereby remove, dissolved oxygen that is needed by amphibians and fish. Algae blooms (increases) can also be detrimental to stream aesthetics.

Less is known about the mechanics of phosphorus behavior during and soon after wildfire. No models are available to accurately predict the movement of phosphorous or nitrogen to a streamcourse. Based on research studies around the Pacific Northwest, the nitrate and phosphate concentrations in stream water will not exceed drinking water standards or cause excessive growth of aquatic vegetation in streams within or below the project area. Thus, there may be slight adverse effects persisting from the fire, but they will have no significant environmental consequences.

Management-induced effects--Relative to the nutrient changes which will be caused by the fire, no additional cumulative changes would result from implementation of any alternative.

Increases in Maximum Stream Temperature

This section is a continuation of Adverse Effects Common to All Alternatives.

Unblocked sunlight on a stream surface is the major contributor to increased water temperatures. Substantial shade was removed when fire consumed shrubs and trees near perennial streams.

Within this analysis, two means of change in water temperature were considered: increases due to the indirect effects of fire, and decreases resulting from shade-producing shrubs which would be planted under an action alternative. Because different water temperature decreases are associated with the action alternatives, this temperature aspect is discussed later under Decreases in Maximum Water Temperature.

Increases in maximum water temperature that would result from any action alternative's implementation would not be different than the increases in maximum temperature expected under the No Action Alternative. BMPs have been designed to prohibit actions which would remove or impede vegetative shade which regulates maximum stream temperature.

Fire-induced effects will have environmental consequences. Incorporating appropriate BMPs with project implementation would ensure that no additional environmental consequences will result under any of the action alternatives. The State-designated Beneficial Uses of project area streamwater would not be negatively affected by a maximum temperature increase under any of the action alternatives. Cumulative effects analysis shows that there would be no additional effects produced by the implementation of an action alternative. The Oregon Water Quality Standard for no further increase in water temperature when maximum temperatures are already above 68 degrees Fahrenheit will be met regardless of which alternative is implemented.

Fire-Induced effects--Reviewers can consult the Fisheries resource section of Chapter IV for a discussion of the effects of temperature increase on fish and aquatic life.

In this discussion of water temperature change, the condition of the shade-producing riparian vegetation that existed before the fire is known. The temperature values obtained are thus cumulative values.

The Oregon water temperature quality standard specifies that any stream temperature over 68 degrees F is critical. Application of this standard requires that the maximum stream temperature be known. Maximum water temperatures occur when streamflow is lowest. In the Tepee Butte analysis area, lowflow almost always occurs in the late summer just before the fall rains begin. Thus the maximum water temperatures described below are for late August and early September.

Recovery of riparian vegetation is expected to be moderately rapid in Cherry Creek (see Chapter IV, Vegetation Management). Maximum daily stream temperatures are predicted to increase from approximately 60 degrees F before the fire to an average 69 degrees F during the first summer after the fire. The magnitude of the temperature increase over the pre-fire maximum will then decline as shrubs re-colonize the streambanks and provide shade. The maximum stream temperature in Cherry Creek should return to pre-fire levels within 10-12 years after the fire.

The magnitude of the temperature increase will be greatest in Cook Creek, where the pre-fire daily maximum temperature averaged 60 degrees F. Due to the loss of shade and low summer streamflow, stream temperatures are predicted to reach 88 degrees F during the first summer after the fire. Natural recovery of vegetation is expected to lower this maximum to an average of 63 degrees F within ten years after the fire, and temperatures should return to pre-fire levels within 15-20 years.

The loss of shade was greatest in the Cottonwood Creek watershed, but due to greater summer base flows, the magnitude of the temperature increase is not as great as in Cook Creek. The pre-fire maximum daily temperature averaged 62 degrees F, and the predicted maximum during the first year after the fire is 87 degrees F. The maximum temperature is predicted to recover to an average of 63 degrees F within ten years after the fire, and full recovery to pre-fire levels will take 12-15 years.

Temporary increases in maximum daily stream temperatures are predicted for Eureka and Knight Creeks. Full recovery is expected within 5-10 years.

The cumulative impact of increases in the maximum daily stream temperature in Cherry, Cook, Eureka, and Knight Creeks on the Snake River will be insignificant. Since these streams represent less than 1 percent of the flow of the Snake River, they do not significantly influence the temperature regime of the larger river.

Within the fire area, elevated temperatures in Cottonwood Creek may have an effect on the lower reaches of Cottonwood Creek, downstream of the fire area. The maximum temperature at the mouth of Cottonwood Creek prior to the fire was 73 degrees F. During the first year after the fire, increased temperatures in the upstream portion are predicted to result in a cumulative increase in downstream daily maximum temperatures to approximately 80 degrees F at the mouth. In subsequent years, however, no measurable, cumulative effect is predicted for waters at the mouth of Cottonwood Creek. Maximum temperatures further downstream in Joseph Creek are not expected to be significantly affected. Joseph Creek above its confluence with Cottonwood Creek is normally warmer than Cottonwood Creek, and contains five times more water than Cottonwood Creek. Extreme temperature increases at the mouth of Cottonwood Creek would be necessary to significantly affect the temperature of Joseph Creek.

Quantitative values for changes in maximum water temperature are given in Appendix B, Section XIII.

The fire-induced environmental effects of the increase in maximum stream temperature is significant. This significance is further discussed in Chapter IV, Fisheries.

Management-Induced effects--Relative to the predicted, fire-induced, maximum temperature increases, no additional, cumulative effect would result from implementation of any alternative.

No additional maximum temperature increases would occur because the following BMPs were devised and would be implemented under any of the action alternatives -- 2A, 6A, 6B and 6C (see Appendix D). BMP 2A provides for no significant stream shade reduction due to any action alternative salvage harvest within 200 feet of a perennial stream. Additional BMPs (6A through C) provide measures which would prevent livestock from browsing and significantly harming new riparian shrub growth.

Dissolved Oxygen Decrease

This section is a continuation of Adverse Effects Common to All Alternatives.

What happens to dissolved oxygen levels is strongly associated with what happens to water temperature. When water temperatures increase, dissolved oxygen decreases, and vice versa. Oxygen dissolved in water is very important in sustaining aquatic life. Most oxygen in water is absorbed from the atmosphere. The amount of oxygen that can be dissolved in water is depends mostly on water temperature and how rapidly the water's surface, through stream turbulence, can be exposed to the air. For Tepee Butte fire area streams, lack of sufficient turbulence is not a factor that will limit the amount of dissolved oxygen saturating water. Even during low flows the streams are quite turbulent in many places. This leaves water temperature as the primary determinant of saturated (maximum) dissolved oxygen levels.

Therefore, all that was said under the previous discussion on stream water temperature governs what will concurrently happen to dissolved oxygen decreases. No further discussion is given here Other than to summarily state that if stream water temperature is prevented from increasing by the implementation of any alternative, then saturated levels of dissolved oxygen will not be reduced.

Quantitative values for dissolved oxygen decrease are given in more detail in Appendix B, Section XIII. The significance of the dissolved oxygen decreases associated with the pre-fire condition is discussed in Chapter IV, Fisheries.

ADVERSE EFFECTS SPECIFIC TO ALTERNATIVES G, H, I, and J

The sediment and turbidity effects discussed in this section were fire-induced. Additional adverse environmental effects would be expected under Alternatives G, H, and J, but not under Alternative I. Some of the fire's effects are adverse, unavoidable, and significant when the affected resource is compared to its pre-fire condition. In contrast, the effects caused by management activities prescribed under Alternatives G, H, and J are considered not to have a significant environmental effect. There would be no irreversible or irretrievable commitment of resources.

Sediment Change

Sediment movement and deposition in a streamcourse are natural phenomena. For project area watersheds, the sediment source is a combination of both soil eroded from the watershed slopes and eroded soil and larger rock material from the stream channel. A wildfire or a management activity, through its elimination of soil-protecting litter, vegetation, and woody debris on the land surface, exposes bare soil to the primary erosive forces of rainfall and snowmelt runoff. This eroded soil, once it reaches a streamcourse, then becomes sediment, either flowing with the stream or depositing on the streambed. In times of very high streamflow, sediment will be deposited on the floodplain. Within project area streams, sediment could affect a number of Beneficial Uses of streamwater, fisheries uses and human recreational uses.

Prediction of magnitude of sediment change--Estimated sediment output and the changes expected under each alternative are shown in Appendix B, Section XIII. The following is a summary from that appendix, which displays the maximum percentage changes in sediment yields. (see Figure IV-4)

Figure IV-4 Sediment Yield Percent Change Relative to No Action Alternative A

	Alt. G		Alt. H		Alt. I		Alt. J	
Stream	5yr ave	1st yr 1989	5yr ave	1st yr 1989	5yr ave	1st yr 1989	5yr ave	1st yr 1989
Cherry	+0.8	0	+0.3	0	0	0	+0.6	0
Cock	0	+0.1	0	+0.1	0	0	0	+0.1
Cottonwood	+2.1	+1.8	+0.6	+0.5	0	0	+1.0	+1.1

The pre-fire sediment yield condition was calculated to be the same as a pristine condition, (i.e., pre-fire peakflows, average streamflows and hillside erosion were considered to be the same as pristine).

As shown in the above table, all of the sediment yield increases relative to the No Action Alternative are low, the highest being only 2.1 percent. The following discussion specifically relates to the environmental effects of this 2.1 percent increase, but any of the lower values would equally apply. The possibility of significant environmental effects will be assessed for this sediment yield increase.

The sediment yield output, to which the table changes relate, are calculated by methods described in the Appendix B, Section V. In addition, an analysis was conducted to determine the maximum amount of sediment that could be produced through the erosion of channel streambanks resulting from peakflow increases. No research data exists that could be used for the fire area streams to predict this sediment increase amount. Therefore, a simple calculation which involves estimating the area of vulnerable streambank and the depth of erosion into the bank was performed. The sediment amounts obtained were less than 10 percent of the post-fire amounts shown in the tables for 1st year: 1989 sediment yields. Because of this low percentage and because the assumed amounts are professional guesses, these sediment amounts due to peakflow bank erosion were not added to the table values.

The places in the streams (analysis points) that were used for predicting sediment yield values are places where the significance of the sediment increases will be assessed. Significance of an environmental effect associated with sediment is first tested against a Beneficial Use, which in this case primarily relates to fish use. The analysis points are the most representative places for determining the significance of sediment yield increases on fish. Most other streams in the project area do not have a fish resource.

Prediction of the duration of sediment change--Eroded soil from Tepee Butte fire area hillsides is the source of increased sediment yield levels. Greater than 98 percent of the eroded soil will result from indirect effects of the fire. Soil-impacting activities associated with action alternatives will not measurably contribute to additional eroded soil. The duration of the accelerated soil erosion and the simultaneous accelerated sediment production are predicted to be short-term. In six years both processes will be very close to pre-fire levels. See Chapter IV, Soils Resource, for a more thorough discussion of the causes, sources, and duration of the eroded soil and associated sediment yield increases. Streambank erosion caused by rainfall-produced peakflows will also be close to pre-fire levels in six years. Rain peakflow and eroded soil generation are strongly correlated. Depending on the plant association combination within particular subwatersheds, bank erosion caused by snowmelt peakflows will be long-term (greater than five years), lasting 30-50 years. Again, the amount of sediment generated by peakflow will be of small consequence compared to sediment resulting from effects of the fire.

Prevention and minimization of sediment change--The great majority of eroded soil that can become stream sediment originates on log skidtrails, log dragtrails, and roads. These areas very likely are responsible for 90 percent or more of the eroded soil that, if causes are not mitigated, can reach a streamcourse. For the Tepee Butte Fire Recovery Project, a major emphasis in the design of proposed management activities (action alternatives) incorporated mitigation measures which would greatly reduce the amount of eroded soil that reaches a streamcourse. Best Management Practices (BMPs) were designed and designated consistently for each of the action alternatives.

One set of BMPs was designed to prevent (not minimize) all concentrated water runoff that would be produced on a skidtrail, primary dragtrail, or road from reaching a streamcourse. If concentrated runoff can not reach a streamcourse, its contained potential sediment also does not reach the streamcourse. This set of BMPs is described in Best Management Practices 1A through 1G in Appendix D, and is discussed in detail in the Watershed Environmental Effects Analysis Process Paper. Implementation of these BMPs should, as mentioned above, prevent at least 90 percent of the eroded soil produced by management activities from reaching a streamcourse where it would become stream sediment. See Chapter IV, Soils Resource, for a discussion of other BMPs that would be used to minimize other sources of eroded soil. These other BMPs and their associated management activities account for the production of only a very small sediment yield increase shown on the above summary table.

Significance of sediment change--The significance of the environmental effects of the sediment yield increases which would be caused by implementation of any alternative is discussed below. The environmental effects related to sediment change involve ecological effects (either physical or biological), as well as economic and aesthetic effects. The significance of the environmental effects of the sediment increases is determined by the indirect effect of these increases considered in the regulations listed in the first part of this Water Resources section. From that section, regulations which are applicable in assessing sediment are:

*Beneficial Uses (some have been eliminated by previous analysis)
- anadromous fish passage
- salmonid fish rearing
- salmonid fish spawning
- resident fish and aquatic life
- aesthetic quality

*Water quality standards
- formation of deleterious deposits

*Highest and best practicable control of activities

*Anti-degradation policy.

From this list, items under the first two regulations (Beneficial Uses and Water quality standards), except the one for the esthetic Beneficial Use, relate to the fisheries resource. For these fisheries related items, all further information regarding ecological and economic effects, and the significance of these effects reviewers can consult Chapter IV, Fisheries.

From the above list, the highest and best practicable control of activities is achieved for the Tepee Butte Fire Recovery Project through the choice of appropriate Best Management Practices (BMPs). The criterion or standard used to determine the practicability of the BMP activity control was obtained from the Oregon Forest Practices Act and the subsequent Rules for protecting water quality. Each rule relates to what is minimally practicable (reasonable from a cost/benefit standpoint) to use with a specific type of logging activity. From the State's point of view, these are acceptable and appropriate BMPs for effectively protecting water quality. The BMPs for sediment control that were chosen for each action alternative are at least equal in effectiveness to the Forest Practice Rules. Most are even more effective. (see Appendix D) Therefore, with respect to sedimentation, all action alternatives which are implemented with appropriate BMPs will comply with the State regulation which mandate the best practicable control of activities.

The Oregon Anti-degradation policy essentially states that (a) water quality that is better than what is needed to support and maintain Beneficial Uses shall ordinarily not be degraded as the result of human activity. Degradation is described as interfering or becoming injurious to Beneficial Uses. (b) If the Beneficial Use involves a designated National Wild and Scenic River (such as the Snake River), that water quality shall never be degraded by human activity [as defined in (a) above].

With respect to sediment change, compliance with item (b) above is assessed in Chapter IV, Fisheries, and with respect to the aesthetic Beneficial Use, later in this section.

Item (a) above will not apply to project area streams in the short term (next five years). Water quality as it relates to sediment change will not exceed the Anti-degradation policy. However, this has had no influence on the design of action alternatives. Regardless of the fact that water quality is not presently above an acceptable quality level, all action alternatives have been designed to prevent further sediment degradation which interferes with or is injurious to stream Beneficial Uses.

With respect to the aesthetic Beneficial Use of project area streams, implementation of the No Action Alternative may result in a short-term (less than six year) significant adverse effect. Since no mitigating measures are prescribed under the No Action Alternative to counteract this effect, this possible short-term effect would be adverse and unavoidable. The increases in sediment produced by action alternatives are so low that they would have no additional impact on the very extensive sediment deposition that will be caused by the indirect effects of the fire. Implementation of any of the action alternatives would produce no long-term environmental effects.

Most visitors to the affected perennial streams, where most sediment will accumulate, will be "back-country" recreationalists walking the area's designated trails. Of these people, a majority will probably perceive wildfire as a natural event and will not be upset with the sediment deposits they see. Others may find their aesthetic senses offended. It is unknown where the balance will fall. The significance of sediment accumulation on aesthetic Beneficial Use is an open question.

Any short-term effects will last less than six years. Sediment that is deposited on floodplains will be the most obvious aesthetic impact. It is likely that masking vegetation will become fully re-established in these deposits within six years. Riparian areas are very moist environments. New growth and much sprouting of riparian vegetation can be expected. This vegetation will force its way up through sediment deposits. Most people will not be very sensitive to what they see within the stream channels. Stream channels naturally have extensive deposits of sediment. In addition, aquatic plants are expected to help in covering any new deposits within less than six years.

With respect to the aesthetic Beneficial Use within the Snake River Corridor, no environmental consequences are expected. The flow, and thus any contribution of sediment or turbid water, is less than a thousandth of the flow of the Snake River. Input would not be noticeable.

Turbidity Changes

This section is a continuation of Adverse Effects Specific to Alternatives G, H, I, and J.

Turbidity (cloudiness) is a measure of the capability of a given volume of water to transmit light. It is primarily influenced by soil and organic material in suspension. When sediment rates increase, turbidity will increase. However, the exact relationship is unique for each stream, depending on the particle sizes of eroded material.

The relationship between sediment concentration and turbidity varies, depending on particle sizes, shape and angularity, fine suspended organics, and refractive index. It is reasonable to assume for this analysis, however, that estimates of a percentage increase of sediment would be correlated with a percentage increase of turbidity.

Turbidity increases from the fire are expected to mask the increases produced by harvest and road construction activities. As shown in the previous section on sediment change and in the following section on sediment output associated with each alternative, the sediment increases caused by fire are larger percentages than management activity increases. During storm runoff, sediment transport is greatest and natural levels of turbidity are highest. Other sources of natural turbidity increases are related to failing log jams, bank scour from peakflow increase and large woody debris, and sediment in channel deposition bars which become mobilized during infrequent high flows. For these reasons, it is unlikely that management-related turbidities can be discerned from the natural fire-related turbidities.

The significance of turbidity increase is assessed by the established Oregon Water Quality Standard: No more than a 10 percent cumulative increase in natural stream turbidities, as measured relative to a control point immediately upstream of the turbidity-causing activity, shall be allowed. As can be observed from the Standard's language, turbidity is assessed relative to the turbidity level that is already present in the stream when an additional turbidity-producing activity is in progress.

For 2-3 years after the fire, sediment yield and consequent turbidity levels are expected to be very high due to the indirect effects of the fire. The BMPs related to soil and sediment that would be incorporated into all Project activities are designed to prevent turbidity percentages increases above the Standard when the base turbidity levels are very low, ie. at least a couple of orders of magnitude lower than what will be produced by the fire. Therefore, because the turbidity base levels at the upstream control point will be inordinately very high, the implementation of these BMPs will definitely ensure that Water Quality Standards are met.

Relative to the Water Quality Standard, implementation of any action alternative will not produce any significant adverse environmental effects. Reviewers can refer to Chapter IV, Fisheries, for a discussion of the effects and significance of turbidity increases on the Beneficial Uses relating to fisheries. The effects of turbidity increases on the aesthetic Beneficial Use are considered similar enough to fall under the discussion already given in preceding section on Sediment Change.

BENEFICIAL EFFECTS SPECIFIC TO ALTERNATIVES G, H, I, and J

The effects discussed in this section relate to environmental consequences that would be brought about by implementing recovery projects to counteract adverse fire-induced effects.

Decreases in Maximum Stream Temperature

Changes in stream temperatures can affect the health of aquatic biota and cause a shift in species composition. The effects and the significance of stream temperatures on fish populations within the project area are discussed in Chapter IV, Fisheries.

Prediction of magnitude of decrease in maximum water temperature--Detailed temperature output and the changes expected under each alternative are shown in Appendix B, Section XIII. Summarized from this appendix are the following maximum percent changes in temperature. (see Figure IV-5)

Figure IV-5 Percent Change In Maximum Temperatures Relative to No Action Alternative A

Stream	Alt. G 10yr ave	Alt. G Last 5-yr ave	Alt. H 10yr ave	Alt. H Last 5-yr ave	Alt. I 10yr ave	Alt. I Last 5-yr ave	Alt. J 10yr ave	Alt. J Last 5-yr ave
Cherry	0%	0%	0%	0%	0%	0%	0%	0%
Cook	0	-1	0	0	0	-1	0	0
Cottonwood	-1	-5	0	0	-1	-5	0	0

As shown in the above figure, all of the decreases in maximum stream temperature relative to the No Action Alternative are low, i.e., the highest is only a 5 percent reduction. The following discussion specifically relates to the environmental effects of this 5 percent decrease, but any lower values would equally apply. The possibility of significant environmental effects will be assessed for this temperature decrease.

The temperature output to which the table changes relate are calculated by methods described in the Watershed Environmental Effects Analysis Process Paper.

Actual places in the streams (analysis points) that were used to predict water temperature values are places where the significance of the decreases in maximum stream temperature will be assessed. These are the same places that were discussed in the previous section on sediment increases.

Actual stream temperature depends on stream width and length, as well as available remaining shade. These physical characteristics determine the surface area exposed to solar radiation. Streamflow will also affect the magnitude of temperature increase, since the greater the volume of water, the more energy required to raise the temperature.

Brown's temperature equation was used to predict the maximum potential daily temperature for ten years after the fire at points on Cherry and Cook Creeks. Stream temperature was also calculated at the fire boundary on Cottonwood Creek at its confluence with Basin Creek, and at its confluence with Joseph Creek.

Effects of Riparian Planting Projects and Duration of the Effect--This section discusses decreases in maximum stream temperature that would result from the planting of riparian shrubs. See Appendix H, for a full description of these projects. Also see the Wildlife Habitat and Fisheries sections of this chapter for further discussion of the benefits of planting.

-- **Alternatives G and I**

Planting of indigenous shrubs within approximately 23 miles of riparian area would accelerate recovery of stream shading, especially on Cook and Cottonwood Creeks, where fire damage was greatest. This would result in a more rapid reduction in maximum daily stream temperatures. However, growth of these shrubs to a height where they provide substantial shading takes time. It is predicted that the shrubs will reach a height of about six feet in ten years.

Severely damaged stands, as described in Chapter IV, Vegetation Management, and in Chapter III, would be planted in the Fall of 1989 or Spring/Fall of 1990. On Cherry Creek, where less than a mile of riparian area would be planted, full recovery to pre-fire riparian canopy cover is expected within ten years. In the Cook Creek watershed, planting of 6.1 miles of severely damaged riparian areas would result in a reduction of 2 degrees F in the temperature predicted for 1998 under the No Action Alternative. Maximum daily stream temperatures in Cook Creek would likely return to pre-fire conditions within twelve years. Planting of 13.1 miles of riparian area within the Cottonwood Creek watershed would result in a reduction of 5 degrees F by 1998 and a return to pre-fire maximum daily temperatures within ten years.

There will be no measurable effect of these stream temperature increases on the temperature of the Snake River or Joseph Creek. The flow of these two streams is so much larger that the relatively small temperature increase provided by the lesser tributary streams within the fire area will be minimal.

-- **Alternatives H, J, and No Action**

The 2.2 miles of riparian area shrub planting in intensely burned deer and elk summer range and riparian management zones will not have any measurable effect on ten-year average maximum stream temperatures.

Significance of decreases in maximum stream temperature--The following is a discussion of the significance of the environmental effects of decreases in maximum stream temperatures that would be expected under some of the alternatives. The environmental effects related to temperature decreases involve ecological effects (either physical or biological) and economic effects. The significance of the environmental effects of the temperature decrease is determined by the indirect effect of these decreases on the regulations in this section. From that section those that are applicable for assessing temperature are:

*Beneficial Uses (some have been eliminated by previous analysis)
  - anadromous fish passage
  - salmonid fish rearing
  - salmonid fish spawning
  - resident fish and aquatic life

*Water quality standards
  - (none apply for temperature decrease)

*Highest and best practicable control of activities

*Anti-degradation policy.

From the above list, the first regulation (Beneficial Uses) relates to the fish resource. All further information regarding ecological and economic effects, and the significance of these effects is discussed in Chapter IV, Fisheries, and Chapter IV, Wildlife Habitat.

Because only decreases in maximum stream temperature are being addressed in this section, the last two regulations (Highest and best practicable control and Anti-degradation policy), do not apply. The best possible BMP control has been designed into the action alternatives to provide for no increases, and there is no degradation associated with decreases in maximum stream temperatures.

Dissolved Oxygen Increase

This section is a continuation of Beneficial Effects Specific to Alternatives G, H, I, and J.

Changes in dissolved oxygen can affect the health of aquatic biota and cause a shift in species composition. The effects and significance of decreased dissolved oxygen on the fish populations within the project area is discussed in Chapter IV, Fisheries.

Detailed dissolved oxygen output and the changes expected under each alternative are shown in Appendix B, Section XIII. Summarized from this Appendix are the following maximum percentage changes in dissolved oxygen. (see Figure IV-6)

Figure IV-6 Dissolved Oxygen Percent Increase Relative to No Action Alternative A

	Alt. G		Alt. H		Alt. I		Alt. J	
Stream	10yr ave	Last 5-yr ave	10yr ave	Last 5-yr ave	10yr ave	Last 5-yr ave	10yr ave	Last 5-yr ave
Cherry	0%	0%	0%	0%	0%	0%	0%	0%
Cook	0	+1	0	0	0	+1	0	0
Cottonwood	+1	+4	0	0	+1	+4	0	0

As shown in the above figure, all of the oxygen increases relative to the No Action Alternative are low, i.e., the highest is only a 4 percent increase. The following discussion specifically relates to the environmental effects of this 4 percent increase, but any of the lesser values would equally apply. The possibility of significant environmental effects will be assessed for this dissolved oxygen increase.

Actual places in the streams (analysis points) that were used to predict dissolved oxygen values are places where the significance of the oxygen increases will be assessed. These are the same places that were discussed in the previous section on decreases in maximum stream temperature.

What happens to dissolved oxygen levels is strongly associated with what happens to water temperature. This leaves water temperature as the primary determinant of saturated (maximum) dissolved oxygen levels.

Therefore, all that was said under the immediately previous discussion on decreases in maximum stream temperature governs what will concurrently happen to dissolved oxygen increases. If stream water temperature decreases due to implementation of an action alternative, then saturated levels of dissolved oxygen will also be increased.

EFFECTS ON WETLANDS AND FLOODPLAINS (EO 11988 and EO 11990)

The following is a summary of the environmental consequences that relate to wetlands and floodplains.

With respect to effects of the fire on wetlands and floodplains, there will be significant adverse environmental consequences, especially ecologic (biological and physical) and possibly aesthetic.

With respect to the effects on wetlands and floodplains of implementing any of the alternatives (a) there will be *no* adverse environmental effects that are classed as significant, and (b) there will be beneficial environmental effects associated with planting riparian shrubs, but these effects are classed as not significant with respect to water temperature decrease, dissolved oxygen increase and riparian wildlife habitat.

This determination is based on the following facts.

> *No trees will be salvage harvested within wetlands or floodplains adjacent to perennial streams, although some trees will be removed to ensure trail safety.
>
> *There will be no new roads crossing or within the immediate vicinity of perennial streams (Class I, II, or III) or floodplains.
>
> *There will be no salvage logging within 100 feet of sidehill wetlands.
>
> *There are no wetlands adjacent to intermittent Class IV streamcourses.
>
> *There are no substantial floodplains (greater than 10 feet wide plain) adjacent to Class IV streamcourses.
>
> *There will be enforcement of BMPs that prevent damage of riparian shrubs from overgrazing.

FISHERIES

INTRODUCTION

Three fish-bearing streams are within the recovery project area. Cottonwood Creek is a tributary of Joseph Creek, in the Grande Ronde River basin, and has an annual run of anadromous steelhead, as well as resident rainbow trout. Cook and Cherry Creeks are tributaries of the Snake River. Barrier falls in the lower reaches of these two streams block access for anadromous fish. Resident trout populations above these falls have been tentatively identified by Mario Solazzi and Carl B. Schreck of the Oregon Cooperative Fishery Research Unit, as redband trout, a fish which is classified as a Category 2 species (a species needing further study) by the U.S. Fish and Wildlife Service under the Threatened and Endangered Species Act. The relationships between the fire's effects, and the possible effects of management activities on fish habitat are discussed in Chapter III.

Analysis of management alternatives that describe potential consequences on fish habitat and the fisheries resource is discussed below. These environmental consequences are described in four sections. The first section, **Important Interactions**, discusses the interaction of wildfire and fish habitat. Potential effects of fire and proposed management activities on the fisheries resource are explored in this section, and a brief summary of the modeling process used for the analysis is presented. This section is followed by a discussion of the **Effects Common to All Alternatives**. These effects describe changes to the resource which were caused by the fire, and the expected recovery of watershed integrity following the fire. The third section describes **Effects Common to Alternatives G, H, I, and J**. The last section describes the **Effects Specific to Alternatives G and I**.

IMPORTANT INTERACTIONS

Effects on fish habitat were analyzed using the procedure outlined in "Habitat Suitability Information: Rainbow Trout" (USDI Fish and Wildlife Service 1984). "This model uses a modified limiting factor procedure. The procedure assumes that model variables with suitability indices in the average to good range (greater than 0.4 but less than 1.0) can be compensated for by higher suitability indices of other related model variables. However, variables with suitabilities less than 0.4 cannot be compensated for, and thus become limiting factors for the habitat suitability." In other words, as long as all of the habitat variables (components) are fair to good, the overall habitat rating is essentially the average of all of the individual component ratings. On the other hand, if one of the habitat components has a very low rating, good ratings for other components cannot compensate for the low rating. For example, summer water temperatures of 90 degrees for extended periods of time are lethal to rainbow and redband trout. If this condition existed throughout a stream, it wouldn't matter what the spawning gravel quality was, because none of the resident trout would be able to live long enough to spawn.

This procedure was modified for two reasons: 1) to account for the fact that the fish in Cook and Cherry Creeks are redband trout, rather than rainbow trout, and, therefore, have somewhat different environmental tolerances; and 2) because data is not available to supply all of the variables used in the analysis procedure.

Seven habitat variables (components) are used in the analysis process.

1. Average maximum summer water temperature.

2. Average minimum dissolved oxygen (DO) during the summer low water period.

3/4 Summer and winter rearing capacity, as a function of instream cover.

5. Average percent vegetative ground cover and canopy closure along the streambank during the summer for organic input.

6. Average percent rooted vegetation and stable rocky ground cover along stream bank.

7. Percent fines (less than 3 mm) in spawning areas.

Predicted changes in these habitat variables are, for the most part, the result of two basic effects of the fire. The first effect is the loss of riparian vegetation, which varies by the acreage and intensity of the burn in the riparian areas. This directly affects water temperature, dissolved oxygen, organic input, and bank stability (1, 2, 5, and 6). The second effect is an increased amount of sediment delivered to the stream, which varies with the acreage and intensity of the burn on upslope areas. This affects both summer and winter instream cover and the quality of spawning areas (3, 4, and 7). For all variables, the greatest impact occurs in the year following the fire. Recovery of fish habitat condition follows the recovery of the watershed condition.

The changes in riparian vegetation as a result of the fire were estimated based on ODF&W stream surveys (1966 and 1976) and on pre-fire and post-fire aerial photos. Changes in habitat suitability which result from changes in sedimentation were calculated using the "Guide for Predicting Salmonid Response to Sediment Yields in Idaho Batholith Watersheds" (USDA Forest Service 1983). The analysis procedures for the Habitat Suitability Index (HSI) model, the sediment yield and response models, riparian vegetation recovery, and temperature are all described in Appendix B.

The habitat suitability index ratings, by stream, are shown in Alternative Comparison, Chapter II, Figure II-7 and in Figure IV-7 below.

Figure IV-7 Habitat Suitability Index

	Pre-fire	Yr 1	Yr 3	Yr 5	Yr 10
Cherry Creek (redband trout)	0.91	0.10	0.84	0.89	0.91
Cook Creek (redband trout)	0.92	0	0	0.83	0.92
Cottonwood Creek (rainbow/steelhead trout)	0.93	0	0.20	0.86	0.94

It is important to remember that the numbers derived from the HSI model are not absolute measures of habitat capability. When field data is incomplete, the model is used to calculate probable conditions. Models are valid for showing the relative condition of the habitat over time, and for helping to display the habitat components (variables) that are important in causing changed conditions. For the Tepee Butte project area, the ratings for the individual variables and the overall HSI ratings are consistent with professional opinion about what changes can be expected to result from the fire and from proposed management activities. The pre-fire HSI values for Cherry, Cook and Cottonwood Creeks range from 0.91 to 0.93, reflecting nearly pristine conditions in those areas. The variables most closely tied to the condition of riparian vegetation have values at or very near 1.0 for all three streams, reflecting the overall good condition of these riparian areas. The variables more closely tied to sedimentation consistently have values less than 1.0. This would be expected because the natural erosion rates associated with the steep, rocky areas with limited natural vegetation cover common within the fire area, are high enough that there is some sediment deposition in the stream channel even under pristine conditions.

The actual habitat condition and the magnitude of the impacts of the fire will probably vary somewhat from what is predicted by a model, because of such unpredictable factors as: size and duration of spring peakflows, amount and timing of summer precipitation, high intensity storm events, and seasonal and daily temperature fluctuations. For example, relatively slow, steady spring runoff for the first two years following the fire could result in less impact than is predicted; high intensity storms could cause impacts to be somewhat greater.

Also, since the model outputs are expressed as averages, they give a good representation of the overall stream condition, but do not necessarily reflect the conditions at any given location in the stream. This site-specific variability is most important when the HSI ratings approach zero, since the model does not display the fact that there may be areas where the habitat suitability is in fact greater than zero.

Because of these types of variability, there are no models that can accurately predict site-specific habitat conditions over time. And because of these limits on the accuracy and precision of predictive models, it is necessary to monitor habitat condition and populations over time. The monitoring plan for watershed and fisheries is in Chapter II.

EFFECTS COMMON TO ALL ALTERNATIVES

The effects common to all alternatives are the effects of the fire. The habitat variables that have been most severely affected by the fire are those which change as a result of changes in riparian vegetation and sedimentation. Sedimentation is largely controlled by vegetative ground cover over the entire burned area. Therefore, recovery of fish habitat within the fire area will be directly related to the recovery of riparian and upslope vegetation. Due to the differences in the amount and intensity of the burn in the three stream sub-basins, the effects of the fire and the rates of recovery vary by stream. The following discussion, by stream, explains the expected effects on fish habitat over the ten year period following the fire. The first part is based on the numerical estimates derived from the HSI. This is followed by a general discussion of variability due to annual weather conditions and other unpredictable factors.

Cherry Creek was the least intensively burned drainage, especially in the riparian area. Therefore, the habitat variables which are most directly affected by riparian vegetation condition are not substantially affected. The habitat suitability indices for these variables do not drop below 1.0. However, enough area burned within the drainage to increase sedimentation. Therefore, the variables which are most closely tied to sedimentation show changes in the suitability index.

In year one following the fire, sedimentation in spawning gravels is a limiting factor for habitat suitability, with a rating of 0.1. If this condition were expected to be long-term (lasting several years), the potential impact to the redband trout population in Cherry Creek would be very serious. However, watershed recovery in this drainage is expected to be relatively rapid; and by year three, the rating for this habitat variable is 0.6. The overall HSI rating for year three is 0.84, indicating that recovery is expected to be well on its way to a rating of 0.91 in year ten. This is the same HSI rating expressed for the pre-fire condition.

Sedimentation is a large impact in the first two years after the fire, primarily until the vegetative ground cover is re-established. The magnitude of the fire's impact will probably vary somewhat from what is predicted by the model, but the trend should be reasonably close to that predicted. A serious impact on spawning survival is expected in the first year. Less severe effects are expected on summer and winter rearing habitat. The amount of recovery in the second year will be highly dependent on those unpredictable variables identified earlier, but by year three recovery should be progressing rapidly.

The fire was more extensive in the **Cook Creek** drainage than in Cherry Creek. This is particularly true in the Cook Creek riparian area, where over half of the perennial stream length was within areas of moderate- or high-intensity burn. As a result, both summer water temperature and spawning gravel quality will be limiting factors to fish production for about three years after the fire. Spawning gravel quality is rated at less than 0.1 for year one, and 0.2 for year three. The water temperature variable has a rating of zero (the lowest possible value) for the first three years. By year five, habitat condition is expected to show strong recovery. And by year ten, the HSI value is back to the pre-fire value of 0.92.

Taken at face value, these numbers would indicate that there is a high risk of impact to the redband trout population in Cook Creek above the barrier falls. The numbers suggest that populations could be reduced to less than viable numbers as a result of effects of the fire. Assuming that the life history of this population is similar to those populations which have been studied in southeastern Oregon, most fish would be expected to live for three years before spawning once and dying. A small portion of the population would live for four years. Therefore, three years of very low spawning success, especially when combined with low summer survival due to warm water temperatures, could reduce the total population to less than a viable number.

Allowing for individual, site-specific and annual/seasonal variability, some of the population will probably survive. Some individuals can withstand warmer temperatures than others. Headwater reaches and stream reaches with water temperatures moderated by springs, will continue to provide refuges during warm water periods. Spawning gravels in the tailout of plunge pools, which are self-cleaning, will still provide some suitable spawning areas. Relatively cool, damp summers for the next three years would greatly reduce the potential impact on summer rearing. If a viable population can survive through the first three to four years (habitat conditions are expected to recover sufficiently by that time), the population could rebound along with the continued recovery of habitat condition.

The outlook for this analysis would be worsened by a continuation of the drought that preceded the Tepee Butte Fire. Under drought conditions, streamflows are below normal and water temperatures are above normal. However, sedimentation rates are typically lower. Compounding the effects of the fire with the effects of a continued drought could reduce the number of trout in Cook Creek to below a viable population.

Monitoring fish populations and habitat conditions in all streams within the project area should continue for at least ten years. Cook Creek especially should be monitored, to determine if a viable population of redband trout is surviving. Assuming that the population is not eliminated, it should begin to recover by about year five. By year ten the population should be strong again.

Cook and Cherry Creeks flow directly into the Snake River. Since the combined flow of these two streams is less than 0.1 percent of the Snake River in this area, no measurable downstream effect on fish habitat will result from the fire.

Cottonwood Creek was the most severely burned of the three main riparian areas in the fire. About three-fourths of the riparian area along the perennial portion of this stream burned with moderate- or high-intensity. Because Cottonwood Creek has a higher flow than Cook Creek, the effects on fish habitat are not as severe, nor are they expected to be as long lasting. Because this stream does not have any barriers to fish migration, there is not the potential to reduce an isolated population to less than a viable number. Still, the effects of the fire on Cottonwood Creek are expected to be severe for the first few years after the fire.

In year one, both temperature and percent fines in spawning gravels are limiting factors, with index ratings near zero. Both resident and steelhead trout production in Cottonwood Creek are expected to be quite limited -- probably less than 10-20 percent of pre-fire condition. Again, much of the fish production that does occur will be due to site-specific variability. In year three, temperature is still a limiting factor, with an average rating of about 0.2. Because of this stream's greater hydraulic energy, as compared to Cook Creek, spawning gravel quality is expected to show rapid recovery by year three. In year five the overall HSI rating is 0.86, indicating that habitat condition is well on its way to recovering to the pre-fire rating of 0.93.

The effects of the fire on water quality, and therefore on fish habitat, will continue downstream in Cottonwood Creek; these effects will be moderated as the water flows through stream reaches that have not been affected by the fire. Riparian vegetation will provide shade to lower water temperature, and the amount of sediment deposition will decrease progressively downstream. Fish habitat in Joseph Creek (downstream from Cottonwood Creek) should not be substantially affected. Joseph Creek above its confluence with Cottonwood Creek is warmer than Cottonwood Creek, and has over five times the flow. Therefore, temperature and sediment deposition should not be appreciably affected by the fire.

EFFECTS COMMON TO ALTERNATIVES G, H, I, AND J

For all of the action alternatives, the predicted watershed cumulative effects are insignificant in terms of potential cumulative effects on fisheries. The largest change predicted is under Alternative G. The minor increase (beyond post-fire conditions) in sediment reaching the streams under this alternative would only result in a predicted increase in sediment deposition of less than 1 percent. This small amount of change is below the sensitivity limits of the fish response model and is too small to monitor or accurately measure. Therefore, no measurable adverse cumulative effects on fish habitat within the project area would be expected from implementation of any alternative; nor would any effects be expected on the Wild and Scenic Snake River.

EFFECTS SPECIFIC TO ALTERNATIVES G AND I (Alternatives that include substantial riparian planting)

Hand planting riparian vegetation would not result in a substantial increase in shade during the first few critical years, when water temperature is a limiting factor for fish habitat. It would help, however, to ensure that riparian recovery proceeds at least as rapidly as modeled. Such measures would fill-in gaps where natural regeneration might be delayed. This would be most important in Cook Creek, where the duration of severe post-fire impacts could be critical in maintaining a viable redband trout population. Riparian plantings are discussed in more detail in the Vegetation Management section of this chapter.

WILDLIFE HABITAT

Implementing any of the alternatives would have a variety of effects on wildlife resources. These environmental effects are presented in four sections. The first section, **Important Interactions**, contains general introductory material. The remaining three sections discuss specific effects by three categories: **Effects Common to All Alternatives, Effects Common to Alternatives G, H, I, and J, Effects Specific to Each Alternative,** and **Other Environmental Consequences**. Reviewers are encouraged to read the wildlife habitat section of Chapter III for explanations of such terms as "indicator species" and "special wildlife areas".

IMPORTANT INTERACTIONS

Timber management activities, as well as fires, will usually increase the proportion of acres in early successional stages of vegetative development within a given area. Improved forage quantity and quality for many game and non-game wildlife species are the result. In the Tepee Butte Fire area much wildlife habitat, including mature and old growth forest, decreased appreciably where the fire burned intensely. As grass and shrubs return in the early successional stages, habitat is provided for a number of wildlife species. Reforestation accelerates the progression through successional stages toward climax forest.

Because a high forage-to-cover ratio was created by the fire, and because only dead and severely damaged timber would be removed in proposed salvage operations, it is assumed that only minor additional effects would result from harvest. However, future harvest of green timber in the area would have very important cumulative effects on wildlife, especially where cutting units are near the intensely burned areas. Managers must therefore consider wildlife management objectives in the event future harvest in the project area is planned.

Unmanaged forest stands usually provide for maximum populations of all local woodpecker species. Timber harvest reduces the number of available snags. The Comprehensive Management Plan (CMP) for the Hells Canyon NRA requires that sufficient wildlife trees be maintained to support 60 and 100 percent of maximum population levels in the DR/TM and Forage allocations, respectively. The CMP also states that the 100 percent snag level will be maintained when salvage harvest is undertaken in the DR/TM allocation. The fire has created snag habitat well in excess of what can be used by maximum woodpecker populations, although some of the intensely burned areas are without live trees for future snag replacement. Territorial competition between individuals of the same species would likely be the limiting factor for population numbers in the near future.

Large woody material is important to wildlife and other resources. In some areas the fire has created a large supply of woody material that will eventually fall to the ground in amounts exceeding the known requirements of wildlife. In addition, a minimum of five pieces of large, woody material per acre will be left on harvest areas when salvage operations are complete.

Increased traffic on roads built to access timber harvest areas can disturb wildlife. Animals move around more as the traffic increases. Game species become more vulnerable to both legal and illegal hunters. Closing access routes can reduce traffic and human disturbance and will increase wildlife use of forage areas. Closures can also provide non-motorized hunting opportunities. Road closures will be in effect within 30 days of the signing of the Record of Decision under any of the alternatives.

Direct interactions between the effects of fire and wildlife populations vary widely. Fire produces a sudden and drastic modification of habitat structure and local micro-climates for all terrestrial wildlife. These effects may have positive or negative influences, depending on the species involved. Because of its complexity, the long-term influence of post-fire vegetation succession on wildlife populations cannot be generalized. Some of the most significant effects, however, will occur in the first two decades. Vegetation growth and species composition change are the driving forces in a dynamic system; some species are favored and others are not (Lyon 1978).

The Habitat Effectiveness Index (HEI) for Rocky Mountain elk will be used in this discussion to measure the change in habitat components under each alternative. This index can be used as a measure of change for all wildlife species which use this particular habitat. The HEI represents a combined measure of the quality of cover, the spatial arrangement of cover and forage, and the effects of roads which are open to motorized traffic.

Road closures, proposed in this analysis for a variety of resource reasons, will help mitigate reductions in habitat capability caused by human and/or vehicle disturbance. An area of poor cover, which would ordinarily not be used, would become more desirable when disturbance is reduced. Road closure is the key project activity for mitigating the adverse effects of fire and salvage harvest in wildlife habitat areas.

EFFECTS COMMON TO ALL ALTERNATIVES

Indicator Species

Discussions of direct effects under each alternative also serve as a description of cumulative effects on big game and other species which use the same habitat. The current target of 3,600 deer and 3,500 elk for the Chesnimnus Big Game Unit will be maintained. Changes in the number of elk and deer hunting tags issued by the Oregon Department of Fish and Wildlife may be necessary to maintain the target population numbers.

As a result of the fire, approximately 90 percent of the mature and old growth forest habitat no longer meets the definition of old growth. The remaining 2,142 acres would continue to provide habitat for the two indicator species--goshawk and pileated woodpecker--and other wildlife species which use this forest type. Viable populations of both indicator species should remain. However, decreases in total numbers of each species may occur.

The current number of snags exceeds the 100 percent habitat level for woodpeckers throughout the project area. This will increase the numbers of the two indicator species--the black-backed three-toed and northern three-toed woodpeckers--and all other species which use this habitat. In the high-intensity burn areas no replacement snags will be available. In the low- and moderate-intensity burn areas adequate replacement snags will be available.

Green Trees

Individual trees, small clumps of trees, and islands of green trees provide valuable diversity within large intensively-burned areas. These areas would, over time, become composed of large even-aged timber stands. Large islands of green trees, generally greater than 6 acres, would provide summer thermal cover.

The acreage of timber stands classified as cover will be affected by post-burn tree mortality. A large number of trees that appeared green immediately after the fire will die within two years. These trees, mainly grand fir, Engelmann spruce and subalpine fir, have thin bark and consequently are less fire resistant. The post-fire cover (marginal and satisfactory) totals approximately 9,100 acres. In two years, the post-fire cover will be reduced to approximately 5,300 acres.

Special Wildlife Areas

Meadows would follow a path of natural succession. No additional enhancement or maintenance activities are planned for these areas under any of the alternatives.

Stands of dead and live trees would continue to provide wildlife habitat around cliffs and rock outcrops.

EFFECTS COMMON TO ALTERNATIVES G, H, I, AND J

Wildlife habitat enhancement projects under each of the four action alternatives would include the reforestation of selected areas, the closing of some existing roads to reduce harassment, and the planting of selected riparian habitat areas. These projects would create diversity, improve cover, and decrease harassment from motorized vehicles. Improved health, increased populations and a greater variety of some wildlife species would be a direct benefit.

Indicator Species

Intensely-burned acreage neither provides nesting and solitude for goshawks or pileated woodpeckers, nor cover for Rocky Mountain elk, although forage for these species may be enhanced. Timber salvage on intensely-burned sites would have little impact on adjacent sites, which contain the area's remaining cover and potential designated old growth areas. No salvage activity will be performed on these unaffected areas. Under each alternative, the remaining satisfactory and marginal cover (except marginal cover with high susceptibility to insect damage) will be retained and will, therefore, not be affected by project activities.

No harvest activity is proposed in areas identified as mature and old growth forest. Viable populations of goshawks and pileated woodpeckers will remain. In the short term (0-80 years), the total number of individuals per species will decline within the project area. In the long term (80-200 years), when regenerated timber reaches maturity, the number per species will approach the pre-fire situation.

Black-backed three-toed and northern three-toed woodpecker populations will increase as long as standing snags remain (approximately 20 years). To ensure longevity, large diameter snags will be designated for protection. The low- and moderate- but not the high-intensity burn areas contain enough green trees to serve as replacement snags for future needs. Reforestation will be accomplished in selected high-intensity burn areas under all of the alternatives. Eventually (80-100) years), this regeneration will provide green trees of sufficient size to become replacement snags. Once the current snags begin to fall, the numbers of animals which use this habitat will begin to decrease.

Identified Big Game Travel Corridors

Big game travel corridors are maintained under all alternatives through maintenance of designated old growth areas, prescriptions for no salvage harvest in satisfactory cover stands, and application of visual quality constraints on the remaining area.

Designated Old Growth Areas

The wildlife habitat section of Chapter III describes the fire-caused loss of designated old growth areas. A total of 376 acres of additional suitable replacement old growth parcels within the DR/TM allocation will be identified before the Final Environmental Impact Statement (FEIS) is completed. The total area of designated old growth habitat will be approximately 715 acres when replacement parcels are included. The Oregon Department of Fish and Wildlife and the USDA Forest Service will field-verify all selected designated old growth areas.

Special Wildlife Areas

The Frog Pond on Cold Spring Road (Forest Road 4680) will be made into a special habitat area. An exclosure will be designed to keep out domestic livestock and discourage human activity. Livestock watering will be provided for at the site.

Riparian shrubs will be planted in study plots along approximately 1.5 miles of riparian habitat within the project. Data from this study will be used in prescribing future planting projects (see Appendix H).

EFFECTS SPECIFIC TO EACH ALTERNATIVE

ALTERNATIVE A

Short-term changes in wildlife habitat produced by the fire (described in Chapter III) would not be affected if this alternative were implemented. The natural succession of vegetation would determine habitat conditions and wildlife populations in the future.

Indicator Species:

In high-intensity burn areas almost all large woody material on the ground and most soft standing snags were consumed by the fire. Additional woody material will be available as standing dead trees decay and fall, especially in the high-intensity burn areas. Small animals that use this habitat will reach high population densities in the first decade after the fire.

Viable populations of goshawks and pileated woodpeckers should remain. No activity would occur in the remaining mature and old growth timber areas, which constitute habitat for these species.

Since the snag level exceeds 100 percent on all CMP allocations, the populations of the two indicator species--the black-backed three-toed and northern three-toed woodpecker--will increase to the point that territorial competition will be the limiting factor. A shortage of live replacement snags will occur on high-intensity burn areas. Regeneration of replacement trees will be slow (100-200 years) in these areas.

The elk Habitat Effectiveness Index (HEI) under this alternative would be 54.6 (Figure IV-8). The satisfactory and marginal cover remaining after the fire will not be altered (see Figure IV-9, Post-Fire Mortality Cover/Forage Map). The natural process for cover replacement will occur over time.

Figure IV-8. Habitat Effectiveness Index

	Pre-Fire	Post-Fire (1989)	2nd Yr Post (1990)	Alt. A	Alt. G	Alt. H	Alt. I	Alt. J
WINTER RANGE								
Total Cover	95.9	80.4	70.4	70.4	70.4	70.4	70.4	70.4
Spacing	56.6	33.6	24.2	24.2	24.2	24.2	24.2	24.2
Road	95.0	95.0	95.0	95.0	98.0	98.0	95.0	98.0
HEI	78.9	63.8	54.8	54.8	55.4	55.4	54.8	55.4
SUMMER RANGE								
Total Cover	94.4	80.9	70.8	70.8	70.8	70.8	70.8	70.8
Spacing	90.3	69.5	50.9	50.9	50.9	50.9	50.9	50.9
Road	56.0	56.0	56.0	56.0	72.0	72.0	64.0	65.0
HEI	78.3	68.3	59.0	59.0	64.1	64.1	59.0	61.9
SUMMER AND WINTER RANGE								
(% Cover)	35.0	15.0	9.0	9.0	9.0	9.0	9.0	9.0
Total Cover	95.0	80.8	70.7	70.7	70.7	70.7	70.7	70.7
Spacing	67.9	45.8	33.2	33.2	33.2	33.2	33.2	33.2
Road	68.0	68.0	68.0	68.0	90.0	90.0	83.0	85.0
HEI	76.2	63.4	54.6	54.6	59.9	59.9	58.3	58.7

The current open road density (miles per square mile) would not be increased from the pre-fire level (0.8). The area's wildlife would suffer an increase in vehicular disturbance because screening would be gone.

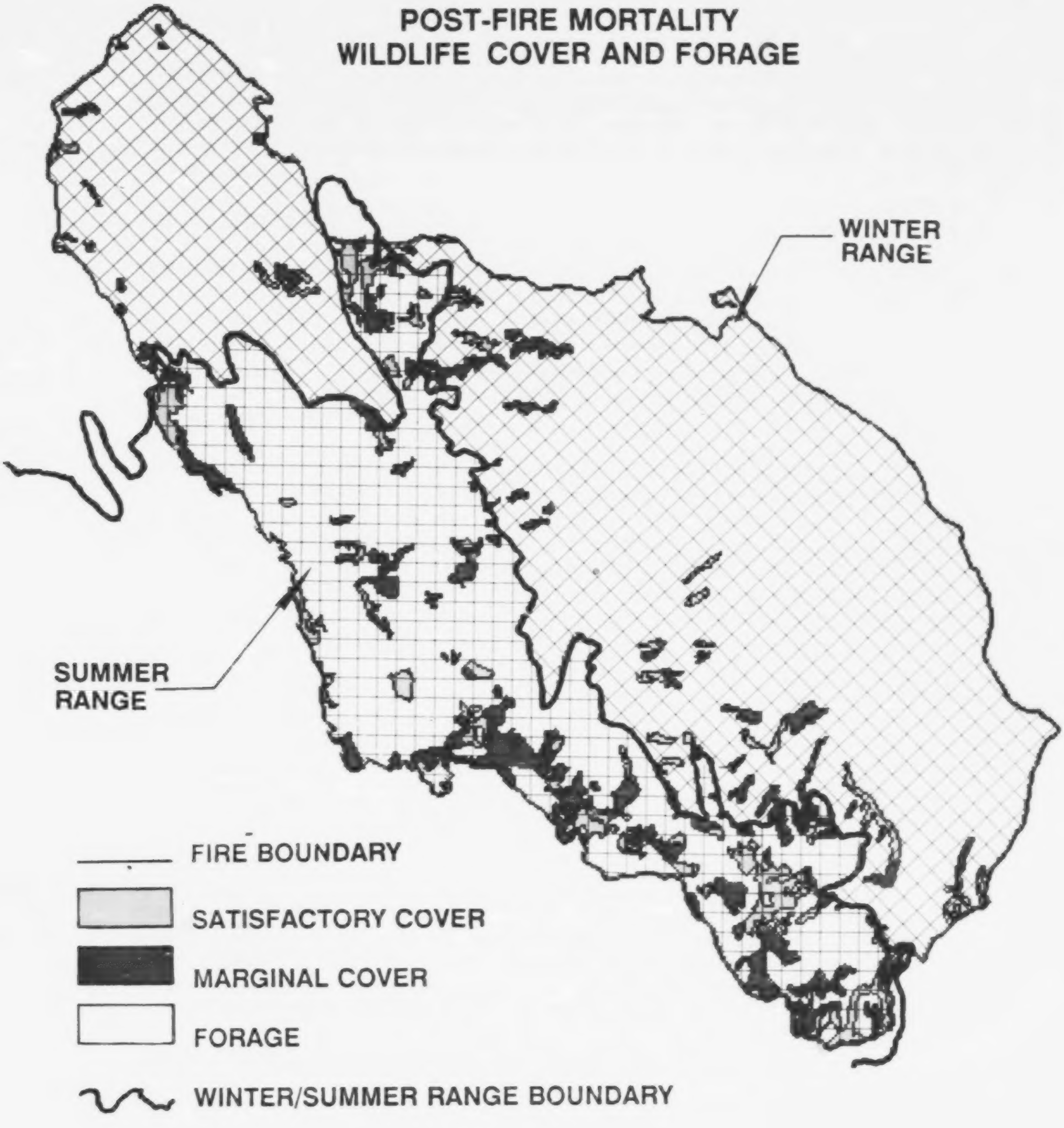
Big game travel corridors will be maintained.

Special Wildlife Areas:

Since no management activities are proposed under this alternative, the quality of riparian habitat would remain at reduced levels in all areas where multi-story stands were damaged or destroyed by the fire. Riparian areas would remain important to wildlife, however, as natural succession occurs and habitat recovers.

Figure IV-9

POST-FIRE MORTALITY
WILDLIFE COVER AND FORAGE


WINTER RANGE
SUMMER RANGE
FIRE BOUNDARY
SATISFACTORY COVER
MARGINAL COVER
FORAGE
WINTER/SUMMER RANGE BOUNDARY

ALTERNATIVE G

Under this alternative, satisfactory and marginal cover would remain the same as described under Alternative A. The maximum number of roads would be closed, contributing to a major reduction in harassment of wildlife. No trees will be left as visual buffers along the main roads (46 & 4680) under this alternative. Visual screening and hiding cover would be reduced.

Indicator Species

Under this alternative the elk HEI would be 59.9 (see Figure IV-8). This alternative prescribes the maximum number of closed roads (12.4 miles). 30.7 miles of "countable" roads would remain open. Year-round road closures would reduce the amount of vehicular disturbance to elk and all other wildlife which use this habitat. The cumulative effects of cover loss would be mitigated by road closures and the HEI would be improved. Once marginal cover is established in the fire area, the need for some of the road closures could be re-evaluated (approximately 15 years).

This alternative prescribes artificial regeneration on 608 and 269 acres of DR/TM and Forage allocations, respectively, expediting the recovery of big game cover. In the Forage allocation, areas would be planted with trees where successful regeneration could be expected. Areas of low regeneration potential would not be planted. Salvage timber harvest will occur within selected units of the Forage allocation. K-V dollars can therefore be collected for reforestation. None of the post-fire satisfactory cover would be disturbed by salvage operations. Harvest entry into the marginal cover stands (388 acres) is proposed, to reduce the potential of Douglas-fir bark beetle infestation.

Special Wildlife Areas

Approximately 23 miles of riparian areas would be planted with native shrubs. High- and some moderate-intensity burn areas would be planted to expedite the recovery of riparian vegetation, reduce stream temperature, and provide habitat for wildlife species.

ALTERNATIVE H

Implementation of this alternative would maintain all the post-fire satisfactory cover and sanitize selected marginal cover areas (280 acres) which are susceptible to Douglas-fir bark beetle infestation. Post-fire wildlife conditions would be improved by maximum road closure and artificial regeneration within selected areas. Proposed salvage units were selected on the basis of need for improved wildlife cover.

Indicator Species

The elk HEI would be 59.9 (see Figure IV-8) under this alternative which, along with Alternative G, prescribes the maximum road closure of 12.4 miles. Open "countable" roads would remain at 30.7 miles. As high-intensity burn areas regenerate over time to marginal cover, selected roads may be re-opened (in approximately 15 years). Again, road closure has been shown to be necessary in reducing the cumulative effects of the fire and salvage harvest on wildlife.

Under this alternative 170 and 269 acres of DR/TM and Forage allocations, respectively, would be artificially regenerated. No salvage would occur within the Forage allocation. The same units which would be planted under Alternative G would be planted under Alternative H. The units would be selected on the basis of regeneration potential.

Over the entire project area, partially burned stands which are not entered for salvage would serve as additional short-term hiding cover for deer and elk.

Special Wildlife Areas

Under this alternative approximately 2.2 miles of riparian habitat area would be planted with indigenous shrubs. Shrubs would be planted where the fire burned riparian vegetation at a high intensity, and in the Cottonwood, Cook and Cherry Creeks deer/elk summer range.

ALTERNATIVE I

This alternative is similar to Alternative A in prescribing no salvage harvest. Consequently, all the remaining satisfactory and marginal cover is retained. A few roads will be closed (11.3 miles) to facilitate recreation opportunities and provide for wildlife needs. Several areas will be regenerated to improve visual quality.

Indicator Species

Under this alternative the HEI for elk would be 58.3 (see Figure IV-8). This is lower than Alternatives G and H because 50.3 miles of open "countable" roads are proposed. Only the Wildhorse Road (Forest Road 46596) would be closed specifically for wildlife needs under this alternative. It could be re-opened in approximately 15 years when marginal cover has returned to the high-intensity burn areas. The remaining roads, which are closed to satisfy recreation needs, will also benefit wildlife.

To improve visual quality, this alternative prescribes reforestation of 303 acres. Reforestation would also benefit wildlife because cover would be improved and replacement snags would be created.

Special Wildlife Areas

Approximately 23 miles of high- and some moderate-burn riparian areas will be planted with indigenous shrubs. This effort will expedite the recovery of riparian brush, reduce stream temperature, and provide habitat for wildlife species.

ALTERNATIVE J

This alternative is similar to Alternative G in prescribing retention of all satisfactory wildlife cover (388 acres), and selected marginal cover where Douglas-fir bark beetle infestations are likely. An increased emphasis on visual quality management is planned under this alternative. Additional hiding cover would be maintained along main roads 46 & 4680. A medium amount of roads would be closed (12.2 miles).

Indicator Species

Under this alternative the HEI for elk is 58.7 (see Figure IV-8). This is lower than is proposed under Alternatives G and H because additional roads would remain open. 37.7 miles of "countable" roads will be kept open. Selected roads could be re-opened after burn areas have regenerated to marginal cover. Road closures would serve to mitigate the fire's effects and salvage harvest effects on big game.

Under this alternative, 608 and 269 acres of DR/TM and Forage allocations, respectively, would be artificially regenerated. No salvage harvest is prescribed within the Forage allocation, even though the same units which would be planted in Alternative G would be planted under this alternative. Harvest units would be selected on the basis of regeneration potential. Reforestation will expedite the return of cover within high-intensity burn areas.

Special Wildlife Areas

Approximately 2.2 miles of riparian areas would be planted with indigenous shrub species. Shrubs would be planted where the fire burned riparian vegetation at a high intensity, and in the Cottonwood, Cook, and Cherry Creeks deer/elk summer range.

OTHER ENVIRONMENTAL CONSEQUENCES

The disturbance of wildlife during implementation of any of the action alternatives is an **adverse environmental effect that cannot be avoided**. This disturbance will be caused by the increase in traffic which results from logging and other recovery-related projects. Several mitigation measures involving road closures will help limit the increase in traffic (see Chapter II, Mitigations).

Under all alternatives, an **environmental effect which will remain unchanged** is the big game forage/cover ratio. The fire changed the ratio from 64/36 to 85/15. The optimum ratio is 60/40.

There are no **irretrievable or irreversible commitments** of wildlife habitat through implementation of any of the alternatives.

There are no effects of **short-term use** of wildlife habitat on **long-term productivity** through implementation of any of the alternatives.

SOILS RESOURCE - LONG-TERM SITE PRODUCTIVITY

INTRODUCTION

Environmental effects of each of the alternatives on long-term soil productivity are presented in four sections. The first section, **Important Interactions**, discusses the interaction and potential effects of wildfire on soil productivity. This section lays the groundwork for the following three sections which describe effects by three categories: **Effects to All Alternatives; Effects to Alternatives A and I;** and **Effects to Alternatives G, H, and J**. Soil erosion losses and post-fire nutrient supply and availability play an important part in this analysis.

IMPORTANT INTERACTIONS

Soil/site productivity is the inherent capacity of a soil to support the growth of specified plants, plant communities or a sequence of plant communities. It may be expressed in terms of volume or weight/unit area/year, percent plant cover or other measures of biomass accumulation. Changes in soil productivity are indicated by changes in soil properties that are expected to result in a reduced productive capacity over the planning horizon. The terms soil productivity and site productivity are used interchangeably in the following discussions.

Site productivity in inland northwest forests is, for the most part, governed by available soil moisture, nutrient supply and temperature (Daubenmire and Daubenmire 1968, Hall 1973). This is true of the lodgepole pine, ponderosa pine and mixed conifer forests. The key for maintaining long-term site productivity in these forests is to minimize displacement, conserve or enhance organic matter, minimize soil structural changes and minimize soil erosion.

Fire has been an important process in shaping our forest and grasslands and their associated soils for centuries. Vegetation in the Blue Mountains of northeastern Oregon developed under the influence of periodic light underburning. Fires occur in the Blue Mountains approximately every 8 to 10 years (Hall 1976). This repeated light underburning results in recycling of nutrients (making them available) that are tied up in litter and duff and larger woody debris. The net effect is to maintain or enhance site or soil productivity.

Widespread, intense wildfires may, however, have more negative long-term (greater than ten years) effects on soil productivity, depending on the intensity and duration of the fires, extent of post-fire soil erosion and the ability of the soil to recover from these impacts within a short period of time. The ability to quickly recover (soil resiliency) depends on the soil's residual organic carbon content, post-fire erodibility and the speed with which ground cover is established.

The effects of the Tepee Butte fire will have both short- and long-term consequences on soil productivity. The magnitude and duration of these effects depend on fire intensities, watershed sensitivities, soil resiliencies, storm intensities following the fire, and the success of the fire rehabilitation revegetation effort.

EFFECTS COMMON TO ALL ALTERNATIVES

Soil productivity is the major soil-related issue for the proposed alternatives. The key indicators used to evaluate the estimated impacts on the soil resource are: (1) post-fire surface erosion rates for soils in the area as affected by no-action and/or recovery activities including harvest systems and tree removal and (2) soil erosion resulting from existing or planned roads. Erosion rates were determined using the "Modified Universal Soil Loss Equation" or MSLE. The MSLE predicts the amount of eroded soil that could reach a functioning streamchannel or a channel that normally carries water during some time of the year. These predictions are based on rainfall intensities, soil erodibility characteristics, vegetative cover and topographic factors. Erosion rates are estimated average annual values. Actual values will depend on vegetative recovery rates and the occurrence of specific climatic events (storm intensities, rain or snow events). Vegetative recovery rates are based on 1986 fire recovery rates. Specific climatic events can be predicted with a high degree of reliability by using data taken from precipitation-frequency maps and the associated precipitation-frequency equations for the desired storm event (Miller et. al., 1973).

Pre- and post-fire rates were determined by using soil survey information, mapped fire intensity, ground cover conditions and topographic details taken from USGS topographic maps. Action alternatives were analyzed using the above information and expected ground disturbance levels by harvest system as reported by Sidle, 1980. Predicted erosion levels are cumulative and are based on erosion from unburned, low, moderate and high intensity burn acres. A detailed description of this analysis procedure can be found in Appendix B.

Fire-Induced Soil Productivity Consequences

Potential consequences of wildfire on long-term soil productivity are governed to a large degree by the intensity and duration of the fire and post-fire climatic events. The fire-induced consequences are:

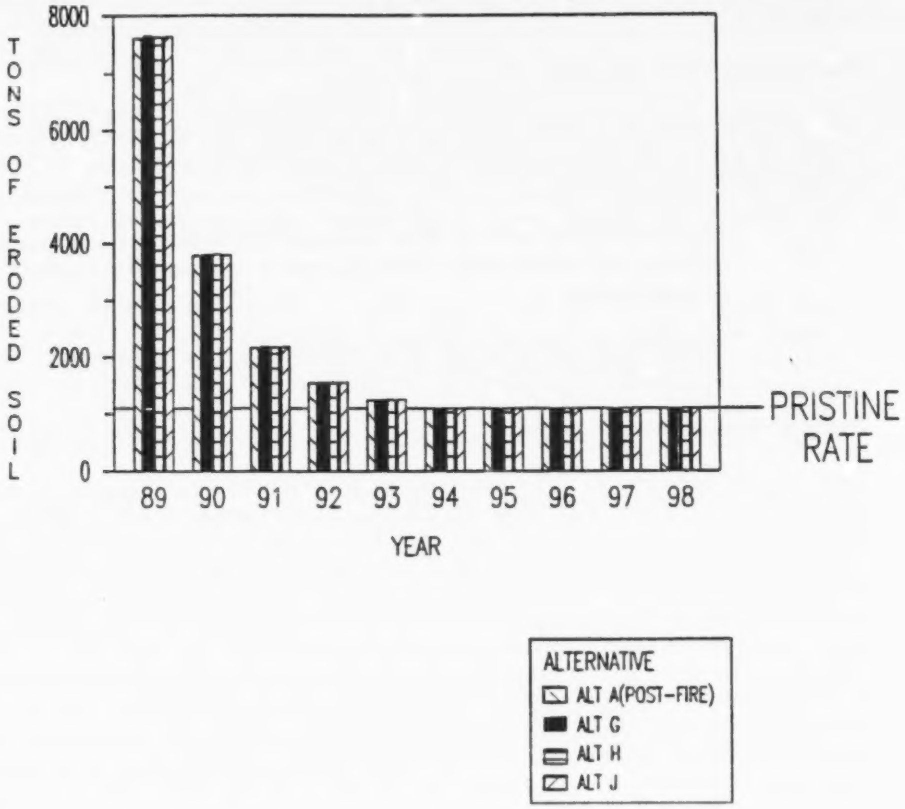
- Loss of protective ground cover, increased soil moisture levels caused by reduced evapotranspiration rates may lead to an increase in overland flows and soil erosion.

- Nutrients will be lost through: combustion of surface and subsurface organic matter, leaching through the soil profile, and by soil erosion.

Surface Erosion Consequences

Natural soil erosion rates within the analysis area range from low in the forested communities to high in the steep, highly dissected grassland communities. The fire, however, has dramatically increased potential erosion rates due to a loss of ground and canopy cover. Post-fire erosion rates are estimated at 81 tons per square mile per year the first year following the fire and will decline over time. Pre-fire erosion levels should be attained by year 6 following the fire. See Figure IV-10 for graphic display of pre- and post-fire erosion rates. These erosion effects are considered to be short-term (less than 10 years). The reduction in erosion rates is due to increases in vegetative ground cover and canopy cover over time. Increases in cover will occur naturally as new trees become established, as herbaceous plants resprout, and as fire rehabilitation seeding is accomplished. These potential soil losses would be a substantial impact to the local area, but would be insignificant when considering the larger area, i.e., the Hells Canyon NRA or Wallowa County. These potential effects are considered to be cumulative and cannot be avoided.

Figure IV-10 Estimated post-fire soil erosion in tons, by alternative, for analysis years 1989 through 1998. Estimated erosion is that soil material that would reach a functioning stream channel.



Productivity Consequences of Soil Nutrient Changes

Nutrient loss following wildfire results from volitalization, leaching through the soil profile, and through wind and water erosion. Surface erosion can strongly affect the loss of nitrogen, phosphorous and sulfur, since these elements are associated with organic matter decomposition and/or combustion. Since potential nutrient losses are strongly associated with burn intensity, a description of effect by this criterion is appropriate.

Consequences of high-intensity burns--Within the analysis area approximately 36 percent of the timbered acres and 4 percent of the grassland acres burned with a high intensity. Overall, 16 percent of the total acres burned with a high intensity.

Potential soil productivity reductions are greatest in areas where the overstory is destroyed and the surface litter and organic matter is completely consumed. High-intensity burns may result in a loss of 70 percent or more of the surface litter and duff and as a result 50-75 percent of the total nitrogen in this surface material may be lost through volatilization (Boyer, Dell 1980). This loss of nitrogen could be critical, depending on the nutrient reserves of the site or soil's resiliency.

The actual effects on long-term (greater than 10 years) site productivity in high-intensity burn areas will depend on site-specific fire intensities and duration and erosion losses. Those areas with shallow, coarse-textured soils, with low soil organic carbon content would have low resiliency. Harsh sites such as this have the potential to sustain negative long-term soil productivity effects. These effects would be realized in areas where accelerated erosion takes place. Deeper (greater than 20 inches in depth), more productive soils, or those timbered sites dominated by volcanic ash surface and subsurface materials, have higher soil organic carbon contents and would be moderately resilient.

For the most part, the high-intensity burns occurred on more productive and resilient soil types. These productive sites have the ability to produce large amounts of biomass in comparison to the less productive sites and, as a consequence, when left untreated they burn with a high intensity. Conversely, they are quicker to establish a protective cover than less productive soils.

While surface fuel consumption within high-intensity burn areas was complete, the overall effect was quite variable. Many areas experienced little or no combustion of organic matter below the soil surface. Some gains in available nutrients will occur in all high-intensity burn areas due to release of nutrients in the ash.

Post-fire long-term soil productivity effects, while locally of importance, are limited when considering a larger land area. Effects may be long-term and irreversible in areas experiencing continued accelerated erosion, but overall these areas will be limited in extent due to natural recovery and the post-fire rehabilitation seeding which will speed the recovery process (See Appendix J for information on erosion seeded areas and acreage).

Consequences of moderate-intensity burns--34 percent of the timbered acres and 7 percent of the grassland acres burned with a moderate intensity. This represents 17 percent of the total analysis area acreage.

Areas experiencing moderate burn intensities may have lost up to 50 percent of the surface litter and duff, with little alteration of subsurface organic materials. Moderate burn areas may have lost up to 50 percent of the total nitrogen available in surface organic material. This loss occurred through the combustion of organic matter. Surface cover losses range from 40-70 percent for a given area. In moderately burned areas, some gains in available soil nutrients may be realized as a result of the fire through the release of nutrients in the ash.

Under moderate burn intensities, a mosaic of burned and unburned conditions is created and, thus, potential erosion is reduced over that of high-intensity burn areas.

The potential for long-term productivity losses in moderate-intensity burn areas is dependent on the extent of surface residue, soil litter and duff consumption and the amount of exposed soil subject to erosion. The potential to effectively manage productivity through on-site mitigation and residue management is good, and long-term productivity losses would be minimized in these areas. Soil productivity effects may be locally substantial but limited in scope and extent. Effects will be short-term (less than 10 years) and cumulative within the analysis area when considering potential effects from high burn intensity areas. No irreversible losses of resources will occur in these areas. Post-fire erosion seeding will mitigate effects in these areas.

Consequences of low-intensity burns--Little modification of surface organic matter and duff occurred in low-intensity burn areas. Erosion potentials were not increased over pre-fire conditions and long-term soil productivity potentials were not affected. Some gains in available nutrients would occur in these areas due to release of nutrients in the ash.

Productivity effects summary--The loss of nitrogen is of particular concern for soils on forested portions of the project area. Potential for nitrogen loss due to combustion of litter and organic matter and through surface soil erosion can be translated into potential losses of long-term productivity. These potential losses have been noted (Klock and Grier 1981, Tiedemann 1981, Harvey et. al. 1987b, 1988a). However, nitrogen loss from the combustion of large woody debris is less important since it is generally unavailable to plants. In addition, while a large percent of the nitrogen is lost through volatilization, usually more nitrogen is temporarily made available in the ash. Additional nitrogen may be replaced by increased biotic activity due to microclimatic changes of increased soil moisture and temperature.

The scope of these potential changes will depend on the type of impacts and the cumulative nature of those impacts.

Loss of nutrients through volatilization, leaching through the soil profile, and due to erosion losses are cumulative, may have high micro-site impacts, and are effects that cannot be avoided. The effects will be short-term (less than 10 years) in areas where soil loss is minimized. Mitigation measures directed at minimizing erosion and/or maintaining or enhancing soil productivity include erosion seeding and maintenance of on-site woody material. Maintaining woody debris on-site will retard erosion and act as a nutrient reservoir.

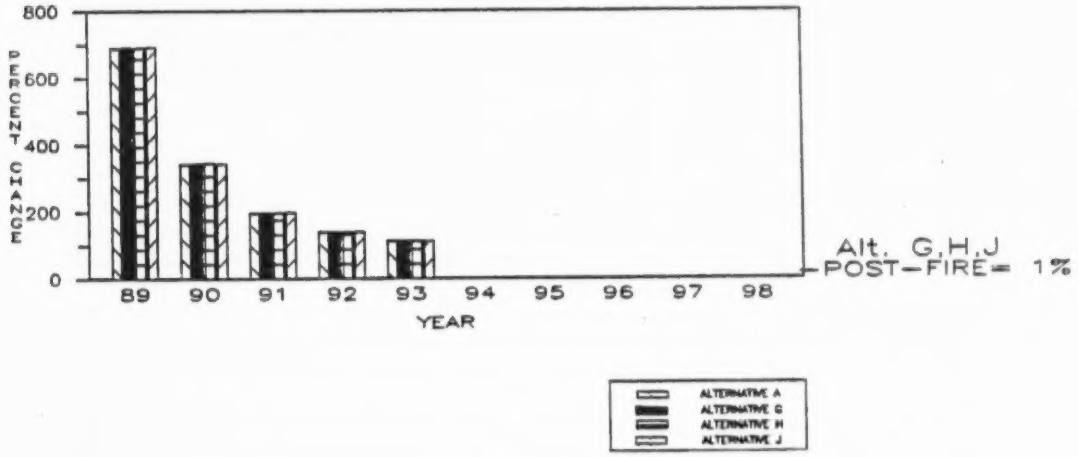
EFFECTS COMMON TO ALTERNATIVES A AND I

Alternatives A and I are equal with respect to the potential of eroded soil reaching a functioning channel. Alternative A is the No-action alternative and Alternative I does not include any salvage harvest of burned materials. The potential effects described above, under "Effects Common to All Alternatives", apply to these alternatives.

Post-fire Recovery

Over time, post-fire vegetative ground cover will equal pre-fire conditions. The rate of ground cover establishment and reforestation will depend on rehabilitation seeding success, the level of management induced reforestation and riparian brush plantings, and post-fire site stability. Since planted seedlings take 2 years or more to become established, they do not appreciably reduce erosion potentials the first three years. Seeding will reduce erosion and sedimentation rates. Pre-fire rates will be attained by year 3. Figure IV-10 graphically displays estimated erosion rates in tons of sediment, by alternative, for the analysis area. Rates are listed for years one through ten. Figure IV-11 displays estimated erosion rates as a percent change from pre-fire and post-fire conditions.

Figure IV-11 Estimated post-fire soil erosion displayed as a percent change from pristine (0%) or natural erosion rates for analysis years 1989 through 1998. Potential post-fire erosion rates for action alternatives are within 1 percent of Alternative A, the no-action alternative.



Where much of the forest canopy was lost during the fire, interception and evapotranspiration would be reduced. Where surface soils are exposed, infiltration and water storage may also be reduced. This may result in an increased water yield and an increase in stream sedimentation in watersheds of high- and moderate-intensity burns. These increases may severely impact the local area but would not significantly affect the Hells Canyon NRA or Wallowa County. These effects are unavoidable and short-term (less than 10 years), and are cumulative. Mitigation is limited to post-fire rehabilitation seeding and/or riparian underplanting.

The opportunity to fell woody material for erosion protection and site productivity enhancement is deferred with these alternatives. Actual recovery will depend on the rate standing, dying timber falls. Small diameter material that has been killed by the fire could be expected to fall within 2-5 years. Larger diameter material (greater than 14 inches) may stand for 10-20 years or longer depending on species and local wind patterns. Post fire erosion rates will reach pre-fire rates by year 6.

EFFECTS COMMON TO ALTERNATIVES G, H, AND J

All action alternatives have been planned to meet Forest Service Pacific Northwest Regional standards for soil productivity protection. These standards are reflected in the choice of Best Management Practices (BMP's) that are associated with each action alternative. These practices are described in detail in Appendix D. In addition, about 15 tons/acre of 3-9 inch woody material will be left on site in areas of planned harvest. This standard is based on work of Harvey et al. 1987b, 1988a, who suggest this amount of residue to provide ample reservoirs for long-term supply of organic material, and to serve as sites for mycorrhizal innoculation and nitrogen fixation.

The effects of these action alternatives on erosion and site productivity are similar. The analysis of effects includes post-fire condition as described under Effects Common to All Alternatives and "management activity-induced" effects. These are considered "cumulative effects".

Potential Management Activity-induced Effects

Potential management activity-induced effects, as they relate to potential long-term productivity effects include: reduction in water infiltration due to soil compaction, loss of surface layers and soil organic matter due to soil displacement; and nutrient losses due to residue removal. The potential for concentrated runoff from roads, skid-roads and landings (resulting in accelerated erosion) increases with slope steepness. Implementation of appropriate Best Management Practices (Appendix D) will be necessary to minimize erosion in these areas. Where canopy cover is lost or removed, the reduced evapotranspiration of water by vegetation may result in ephemeral (Class IV) streams carrying more water. This additional water may result in more streambank erosion sediment production. Sediment yields will be reduced over time; however, increases in sediment over pre-fire conditions may be expected for 5 years or longer.

Vegetative ground cover on areas which were seeded as a part of the fire rehabilitation effort will reduce sediment production. Full recovery (vegetative ground cover) is expected within 3 years on these sites.

These harvest-induced effects can be mitigated through implementation of Best Management Practices (BMPs). These practices include seeding for erosion control, mulching and fertilizing; waterbarring; road closures; subsoiling or tilling compacted skid roads and landings; and numerous other road construction and harvest system mitigation techniques (See Appendix D). Managing for on-site woody debris, for the protection of long-term productivity, is an additional requirement under all action alternatives.

Actual Management Activity-induced Effects

The analysis of these alternatives included an assessment of management impacts not likely to be mitigated due to inaccessibility of the terrain. Erosion estimates reflect these effects. Figure IV-11 shows that estimated erosion rates of action alternatives are within 1 percent of Alternative A, the no-action alternative. While management activities will result in some increase in soil erosion potentials, implementation of Best Management Practices will reduce these potentials to acceptable levels (See Appendix D).

Estimated erosion rates for Alternatives G, H, and J are similar to those calculated for Alternative A. Although these rates would be substantial on some micro-sites, they would essentially be a post-fire effect since 99 percent of estimated erosion is fire-induced.

Therefore, management activities will have no additional measurable effect. The significance, magnitude and duration of these effects are as described under Effects Common to All Alternatives.

VEGETATION MANAGEMENT

INTRODUCTION

The Tepee Butte Fire has created a variety of understocked forest lands that have varying potential for vegetative recovery. This section will explain the important interactions between the fire, the vegetation resource, and alternative management activities for the Tepee Butte Recovery Project.

The section will then discuss the general **environmental effects common to all of the alternatives** and will follow that with a discussion of those **effects common only to Alternatives G, H, and J**. Another portion will deal with the **specific effects of each alternative** within the context of the major issues presented in Chapter I. The level of operability will also be discussed for each alternative. Operability is considered to be the relative ease or difficulty with which timber management practices can be carried out on a given piece of ground. It is a function of, among other things, the amount of roading, the amount of standing dead and downed timber and any other factors that would facilitate or complicate future vegetation management. The last portion of this section will address other general NEPA concerns.

In addition to this chapter, the reviewer may also refer to Vegetation Management and Rapid Timber Recovery in Chapter III, to Rapid Timber Recovery, this chapter, and to Appendix J.

IMPORTANT INTERACTIONS

Wildfire is an integral part of coniferous forest ecosystems. It can produce effects similar to forest management activities by influencing the types and numbers of species that are present as well as their spatial and age-class distribution. It can determine which tree species attain a dominant or subordinate position in the stand. It can alter the course of ecological succession that the stand will follow and affect the success or survival of riparian and forage-producing vegetation.

These factors, along with pre-existing plant associations, affect the range of management activities and the long-term operability (see definition above) of each stand. Operability may be decreased or increased by management activities or lack of activity as specified in the alternatives.

There are 16 forest vegetation plant associations and several grassland types within the fire area. Each plant association reacts to fire according to its physiographic character.

In Douglas-fir/pinegrass plant associations, light to moderate intensity fire will not generally consume mature Douglas-fir but will leave an open understory of pinegrass and elk sedge which becomes more palatable afterward. Fire may retard Douglas-fir seedlings and promote old growth pine stands and sprouting shrubs such as snowberry, spiraea, ninebark, and maple. An intense fire in a Douglas-fir plant community will expose areas of bare mineral soil to allow dormant ceanothus seed to grow and establish dominance (Johnson 1987).

Lodgepole pine produces both non-serotinous and serotinous cones. High intensity fires which destroy lodgepole will cause serotinous cones to open, resulting in abundant regeneration and eventual stagnation. This tendency for lodgepole pine to overstock and stagnate is probably the most extreme of any North American tree species (Johnson 1987).

Grand fir is susceptible to fire and will succumb to even moderate ground fires. Old growth with its thicker bark may survive the fire. Fire scars, however, increase the susceptibility of grand fir to insect attack and fungi damage, particularly the Indian paint fungus. Western larch, Douglas-fir, lodgepole pine, and Englemann spruce are all fire-seral in specific grand fir plant communities. Rhizomatous plants will compete with regeneration in some communities but are not usually detrimental. In grand fir/pinegrass communities, fire disturbance causes increase in heartleaf arnica, strawberries, sticky starwort, bigleaf sandwort, and elk sedge (Johnson 1987).

In grassland areas junegrass is one of the most fire-resistant perennial bunchgrasses and will increase following burning. Fires during dormant season are less damaging to root crowns (Johnson 1987).

For more detailed information on the reaction of plant associations to fire see Appendix J.

Harvesting fire-killed timber would have little long-term effect on vegetation composition, changing only the seedling microclimate and long-term wildfire hazard (see Fire section in this chapter). Post-fire erosion control seeding and artificial reforestation following harvest will change species composition, stand development, and succession.

Road and trail construction directly affects vegetation but the effects are generally not wide spread.

No proposed or existing Botanical Areas or Research Natural Areas are located within the fire boundary.

EFFECTS COMMON TO ALL ALTERNATIVES

The stand composition changed from a pre-fire condition of mature timber to a post-fire condition that ranges from a moderately-stocked timber stand to areas totally denuded. The significance of this change is major but confined to burned areas and results from effects of the fire rather than any specific alternative.

Forest productivity can be related to vegetation development after fire or other disturbances. Changes in long-term productivity can be hard to measure and light disturbances usually have little effect. When the disturbance is severe, however, the productivity of a site may decline. Depending on burn intensities and vegetation recovery, reductions in organic matter may be serious enough to reduce long-term site productivity. Each alternative is designed to maintain varying levels of organic matter. (see Chapter IV, Soil Resources section).

Not all fire-caused mortality can be identified from immediate post-fire aerial photos and ground surveys. Additional trees are expected to die during the summer of 1989 during periods of high moisture stress. Guidelines have been developed from past fire salvage research for identifying trees that are likely to die by the degree of crown scorch and cambium kill. A few dying trees may still escape identification. In the second summer and fall (1990) some losses to bark beetle attack could occur, especially in moderately burned areas where dying trees are not salvaged. During this period, fire-affected stands will be monitored for additional mortality.

EFFECTS COMMON TO SALVAGE ALTERNATIVES G, H, AND J

The effects of salvage alternatives on vegetation are directly related to reforestation levels which are indirectly related to harvest levels since it is usually harvest units that are reforested. Salvage harvest and reforestation differ among these alternatives in their amount and spatial extent. The number of salvage harvest and reforestation acres for each alternative is shown in Chapter II.

Timber harvest activities in fire-killed timber have only minor potential for affecting vegetation composition. Areas harvested using ground-based systems would increase soil disturbance producing a short-term, minor effect on species dominance. During the period immediately following harvest, invading species which thrive on disturbed soils would occupy a greater proportion of the growing space. These populations are generally transitory and diminish as new conifer stands become established.

The amount of conifer regeneration by both natural and artificial methods will determine the long-term species composition on fire affected areas.

Hand planting would be the principal method of artificial regeneration. Optimum conifer stocking levels are to be achieved within five years. Douglas-fir and grand fir were the overwhelmingly dominant pre-fire conifer species in fire-killed stands identified for reforestation. Ponderosa pine and Douglas-fir would be the primary species planted in reforested stands. Other indigenous conifer species such as western larch, Engelmann spruce, and lodgepole pine would be planted where conditions are favorable. Site-specific exams will be conducted prior to planting to determine the success of natural regeneration and the additional planting needed to meet acceptable stocking levels. The alternatives vary in the amount of unharvested suitable land to be reforested. Alternative themes establish criteria for reforestation based on costs and habitat diversity.

Natural regeneration would be most successful in areas where overstory conifers survived, leaving green trees as seed sources, and where site conditions are favorable or the fire has prepared a seedbed. Other factors which will influence the eventual pattern of natural regeneration but which cannot be predicted at this time include seed and cone-damaging insects, seed-eating rodents, actual cone production, and weather conditions after seedfall. Stands expected to have favorable conditions for natural regeneration have been identified and a proportion are projected to be fully restocked by natural seedfall.

All native species have the potential to regenerate naturally if good seed/cone crops occur before grass and shrubs species become too well established. Recent studies on the Wallowa-Snake Province also indicate that most plant associations common to the fire-affected area have a good potential for prompt natural regeneration of openings created by fire or salvage harvesting of fire-killed trees (*Johnson 1987*).

Lightly-burned stands with scattered dead trees would have enough surviving trees to maintain minimum stocking levels after salvage. In these stands, no planting would be planned in small understocked holes because natural regeneration is expected. This mixture of stand types and openings will favor highly diverse species composition and stand structure over time.

After fire mortality has ceased, some stands will be understocked for long-term timber production, but will have sufficient numbers of green overstory trees remaining to provide seed, wildlife habitat, and organic matter retention. Additional fire mortality will change the character of some of these areas but many understocked stands occupied by individual and groups of large living trees will remain.

There are approximately 5,000 acres of previously timbered land of Hells Canyon NRA that generally do not have an adequate seed source for natural regeneration due to fire-caused tree mortality. This situation occurs on 2,070 acres of Dispersed Recreation/Native Vegetation (DR/NV) allocation, 1,040 acres of Dispersed Recreation/Timber Management (DR/TM) allocation, and 1,890 acres of the Forage allocation.

Potential cumulative effects of alternatives include changes in species distribution and stand structure development. The harvest of dead trees would influence these conditions slightly. Reforestation will influence them even more. The development of seral grass and shrub stages may be reduced by alternatives that reforest more acres for future timber management, wildlife, or visual purposes.

Roads would have a minor impact on overall vegetation composition but could affect sensitive plants occupying spatially limited habitats. They are discussed in the Sensitive Plant section of this Chapter.

The increase in long-term operability would be irreversible due to the removal of the volume of fire-killed timber.

EFFECTS SPECIFIC TO EACH ALTERNATIVE

Alternative A

Under this alternative, the only management activities with a direct effect on forest vegetation would be; 1) the erosion control grass seeding that occurred during Fall 1988, and 2) the resumption of forage grazing after a 2-year rest period to protect the erosion control grass seeding. Taking these two measures into account, timber stands within the project area would then develop according to the natural ecological succession pattern for the plant community.

The quality and quantity of natural vegetative regeneration on high-intensity burn timber areas, with no remaining conifer seed source, would depend on whether they were originally timber/grass associations or timber/shrub associations. Shrub and forb regeneration would occur in a fairly short time. Regeneration of tree species, however, would be a very slow process because of the near total loss of seed trees and could take 5-50 years. Without artificial regeneration, large areas of the high intensity burn would be removed from timber production for decades.

High-intensity fire in the timber/shrub types would favor certain shrub species that rely on either vegetative resprouting or seed dissemination. Resprouters include serviceberry, ceanothous, pachistima, chokecherry, currents, gooseberries, roses, thimbleberry, and willow. Airborne and animal dispersal-type seed disseminators include serviceberry, bearberry, Oregon grape, mountain mahogany, juniper, pachistima, ninebark, twinflower, chokecherry, rose, white spiraea and huckleberries. Hot fire in the timber/grass types would favor grass species such as pinegrass, elk sedge, western fescue, and Columbia brome.

Medium-intensity burned areas may develop highly diverse stands of conifers and low shrubs, interspersed with grass areas.

Low-intensity burn areas, with fire resistant tree species such as ponderosa pine and western larch, are expected to retain the characteristics of their pre-fire condition. In contrast, low-intensity burn areas with thin-barked, fire-sensitive species such as subalpine fir and Engelmann spruce tend to have high tree mortality levels due to basal cambium girdling and will be dramatically changed to earlier shrub stages or to seral conifer species such as lodgepole pine and western larch.

The effect of the fire on riparian zones depends upon the composition of the vegetation within the riparian community prior to the fire and upon the burn intensity. Where low- to moderate-intensity burns occurred, shrubs are expected to sprout from root crowns and put out lateral suckers. In high-intensity burn areas, however, root crowns may have been killed, and would take ten years or more to recover. Where the riparian community consisted primarily of conifer trees prior to the fire, recovery would take much longer. Shrubs would colonize new sites previously dominated by trees and seedlings would gradually become established. It is estimated that by following natural processes, Cook Creek would recover to 88 percent of its pre-fire condition and Cottonwood Creek would recover to 73 percent of its pre-fire condition within ten years. The Cherry Creek, Cold Spring Creek, Eureka Creek and Knight Creek drainages would recover to pre-fire levels within 10 years by following natural processes.

For a discussion of the magnitude and significance of the changes in riparian vegetation as well as the irreversible and irretrievable consequences associated with those changes, see the Fisheries section and the Water Resources section of Chapter III.

Not harvesting the fire-killed timber within the DR/TM would represent an irretrievable loss of over 27.5 MMBF. Within 3-5 years after the timber dies, insect attacks, fungal infestations and weathering would render the timber virtually unmerchantable.

Long-term forest productivity, as measured in softwood production over time, would be low. Potential forest productivity would not be realized by the limited number of conifers regenerating naturally where seed sources are limited. Decades may be required for conifer stands to develop in these areas. Again, this would reduce the timber inventory that would be available for harvest from the Hells Canyon NRA and would most likely have a negative impact on the allowable sale quantity.

In comparison with Alternative G, not harvesting 3,084 acres of DR/TM land will render them either non-operable or more difficult to operate due to the quantity, location and arrangement of dead and down timber. This would restrict the range of future land management options. The result is decreased ability to perpetuate healthy stands of diverse tree species, sizes, and age classes, with far fewer vegetation management options available.

The cumulative effect of the reduction of standing timber volume and growing stock along with the loss of soil productivity and the restricted range of management options may require recalculation of the allowable sale quantity for the Hells Canyon NRA over the next several decades (see Social and Economic section of this chapter).

Alternative G

Change in Stand Composition

Under this alternative, 3,353 acres of burned forest land would be salvage logged and 877 acres would be artificially regenerated. The areas artificially regenerated will produce an even-aged stand composed of site-adapted, timber producing species. After 10-15 years in the seedling/sapling stage, these stands would progress to the pole/small sawtimber stage and within 40-60 years, would be ready for commercial timber harvest.

The difference in stand composition under this alternative compared to Alternative A is of minor significance in that both conditions will appear forested at some point in the future. The effect is similar but the time frame is compressed in Alternative G. The extra time it would take Alternative A to appear comparable to Alternative G could be as little as 5 years or it could be as much 50 years or more for some intensely burned areas that lack an adequate conifer seed source.

The rapid development of a forested vegetative cover, as opposed to a slowly developing shrub community, would produce some major indirect effects on the visual resource (see Visual Resource section in this chapter) and on a variety of wildlife habitats (see Wildlife Habitat section in this chapter).

None of the direct effects are irreversible or irretrievable. Few of the indirect effects are also neither irreversible nor irretrievable. Indirect effects on certain plant or animal species may be irreversible if population levels are critically low and the species have very specific habitat requirements (see section on Threatened & Endangered Species in this chapter). Presently, there are no known species within the project area that fit these criteria.

The cumulative effects of the change from a severely burned area to a thrifty young timber stand would produce an indirect effect on some other resources. This would be reflected in the uniformity of both the visual resource and wildlife habitats (see Visual Resource section and Wildlife Habitat section in this chapter).

Reduction or elimination of forage production for grazing animals on timbered lands will be unavoidable during the 20-50 year period after conifer tree regeneration. The first commercial harvest entry will provide an opportunity to once again increase forage production by reducing tree density and increasing the amount of sunlight and precipitation that reaches the forest floor.

Long-term productivity (50 years plus), as measured in softwood production over time, could be maintained or enhanced by the short-term (5 years) actions of site preparation, reforestation, and stand improvement. In addition, soil productivity could be maintained or enhanced by providing an appropriate soil microenvironment (snags and downed logs) for planted seedlings (see Soils Resource section in this chapter).

Accelerated Ecological Succession

The artificial regeneration of 877 acres will alter the course of ecological succession that the stand will follow. Rather than go through a more lengthy stand establishment period, with intermediate stages of forb- and shrub-dominated communities, the stand will move quickly to a seedling/sapling dominated community. This will shorten the period of stand establishment by as much as 5-50 years.

The difference between the ecological succession followed by an unburned mature timber stand and that followed by the artificially regenerated post-fire stand is of major significance. Rather than progressing through a mature forest stage approaching old growth, the stands have had their time frame shifted backwards 100+ years and will now be composed of an even-aged stand, which may also have a slightly different mix of species.

The difference between the accelerated ecological succession of a burned stand artificially regenerated (Alternative G) and the slower rate of succession found in naturally regenerated stands (Alternative A) with its lengthy period of shrub domination, is of minor significance. As with the stand composition, the end result in the long term will be the same; however, the time frames will be compressed. The effect of this change is confined to the locality of the burned area itself.

The accelerated ecological succession of Alternative G compared to Alternative A would have some minor indirect cumulative effects on the visual resource. This would be reflected in slight changes in color and texture of the landscape as the period of the shrub-dominated ecosystems is shortened under Alternative G (see Chapter IV, Visual Resource section). There would also be some minor indirect cumulative effects on the availability of certain wildlife habitats, particularly shrub-dominated habitats (see Wildlife Habitat section in this chapter).

Recovery of Riparian Vegetation

Under Alternative G, 24.2 miles of severely damaged riparian community would be recovered to pre-fire conditions. This includes 1.2 miles of test plots. Recovery would be concentrated in two main drainages, Cook Creek and Cottonwood Creek. In order to accelerate recovery of vegetation, shrubs would be planted in all severely damaged riparian areas. This planting would allow Cook Creek to recover to 97 percent of its pre-fire canopy cover level and Cottonwood Creek would recover to 96 percent of its pre-fire canopy cover level by 1998. Cherry Creek would recover to 100 percent of its pre-fire canopy cover level during this period.

In the event that this planting proves to be unsuccessful and/or impractical, the riparian recovery would revert to its natural rate, which would mean that Cook Creek would recover to 88 percent of its pre-fire condition and Cottonwood Creek would recover to 73 percent of its pre-fire condition by 1998.

For a discussion of the magnitude and significance of the changes in riparian vegetation as well as the irreversible and irretrievable consequences associated with those changes for Alternative G as well as all other alternatives, see the Fisheries section and the Water Resources section of this chapter.

Long-term Operability and Fire Hazard

The harvest of the salvable timber from 3,084 acres of DR/TM Allocation and 269 acres of Forage allocation would have an indirect, but positive, effect on the reduction in fire hazard by removing large amounts of available fuel. The removal of the fire-killed timber from DR/TM lands would cause a positive increase in long-term operability. Long-term operability is not a primary concern on the Forage allocation since the area is not part of the regulated timber base. Increased land operability improves management potential for controlling insect populations, particularly bark beetles. The cumulative effect is increased ability to perpetuate healthy stands of diverse tree species, sizes, and age classes, with more vegetation management options available.

Alternative H

Change In Stand Composition

Under this alternative, 911 acres of burned forest land would be salvage logged and 439 acres would be artificially regenerated. The changes in stand composition would be similar to Alternative G, except that 439 acres of burned forest land would be artificially regenerated, instead of 877 acres as in Alternative G. Of these 439 acres, 269 acres would be site prepped and planted, only they would not be logged. Purpose of this planting is to recover wildlife cover.

Accelerated Ecological Succession

The accelerated ecological succession that would occur under this alternative would be similar to that under Alternative G, except that it would occur on just 439 acres.

Recovery of Riparian Vegetation

This alternative would undertake recovery operations on 3.4 miles (includes 1.2 miles of test plots) the first year in order to determine the most effective techniques for successful riparian plantings. This recovery would be concentrated in two main drainages, Cook Creek and Cottonwood Creek. An additional 20 acres of recovery planting would be undertaken as soon as reliable results from the first 3.4 miles of planting become available.

If the first planting proves to be successful, the subsequent planting efforts would allow Cook Creek to recover to 97 percent of its pre-fire canopy cover level and Cottonwood Creek would recover to 96 percent of its pre-fire canopy cover level by 1998. Cherry Creek would recover to 100 percent of its pre-fire canopy cover level during this period. In the event that this planting proves to be unsuccessful and/or impractical, the riparian recovery would revert to its natural rate, which would mean that Cook Creek would recover to 88 percent of its pre-fire condition and Cottonwood Creek would recover to 73 percent of its pre-fire condition by 1998.

Long-term Operability and Fire Hazard

In comparison to Alternative A, the harvest of salvable timber from 911 acres of DR/TM in Alternative H would have an indirect, but positive, effect in reducing fire hazard and removing available fuel. The removal of the fire-killed timber from DR/TM lands would cause a positive increase in long-term operability. The result is increased ability to perpetuate healthy stands of diverse tree species, sizes, and age classes, with more vegetation management options available.

In comparison to Alternative G, 2,173 acres of timber not harvested in this alternative would cause those acres of DR/TM Allocation to be non-operable or more difficult to operate because the quantity, location and arrangement of dead and down timber. This would restrict the options for future management. The large amount of unrecovered fire-killed timber would also continue to pose a long-term (up to 35 years) fire hazard over much of the fire area. Host material for bark beetles would remain. The cumulative effect would be the decreased ability to perpetuate healthy stands of diverse tree species, sizes, and age classes, with far fewer vegetation management options available.

The cumulative effect of reduced growing stock, along with the loss of productivity and restricted range of management options, may be to require recalculation of the allowable sale quantity for the Hells Canyon NRA over the next several decades.

Alternative I

Change in Stand Composition

Under this alternative, 303 acres of burned forest land would be artificially regenerated, but no salvage logging would occur. This would leave 574 acres of intensely-burned fire-killed timber (compared to Alternative G) to incur a change in stand composition similar to that in Alternative A. The change in stand composition on this 303 acres would be similar to Alternative G.

Accelerated Ecological Succession

The artificial regeneration of 303 acres would alter the course of ecological succession that those stands would follow. These planted acres would go through a pattern of ecological succession similar to the planted stands in Alternative G. The 577 unplanted acres of fire-killed timber would go through a pattern of ecological succession similar to the stand in Alternative A.

Recovery of Riparian Vegetation

Under this alternative, 24.2 miles (includes 1.2 miles of test plots) of severely damaged riparian community would be recovered to pre-fire conditions. This recovery would be concentrated in two main drainages, Cook Creek and Cottonwood Creek. In order to accelerate recovery of vegetation, shrubs would be planted in all severely damaged riparian areas. This planting would allow Cook Creek to recover to 97 percent of its pre-fire canopy cover level and Cottonwood Creek would recover to 96 percent of its pre-fire canopy cover level by 1998. Cherry Creek would recover to 100 percent of its pre-fire canopy cover level during this period. In the event that this planting proves to be unsuccessful and/or impractical, the riparian recovery would revert to its natural rate, which would mean that Cook Creek would recover to 88 percent of its pre-fire condition and Cottonwood Creek would recover to 73 percent of its pre-fire condition by 1998.

Long-term Operability and Fire Hazard

Not harvesting 3,084 acres of the DR/TM Allocation will render those acres involved either non-operable or more difficult to operate due to the quantity, location and arrangement of dead and down timber. This would restrict the range of future management options. The large amount of unrecovered fire-killed timber would also continue to pose a long-term (up to 35 years) fire hazard over much of the DR/TM area. Host material for bark beetles would remain. The result is decreased ability to perpetuate healthy stands of diverse tree species, sizes, and age classes, with far fewer vegetation management options available.

Alternative J

Change in Stand Composition

Under this alternative, 877 acres of burned forest land would be artificially regenerated. 608 of these acres would be salvage logged prior to planting while the remaining 269 acres in the forage allocation would be planted without any salvage logging. The changes in stand composition under this alternative would be identical to those under Alternative G.

Accelerated Ecological Succession

The pattern of ecological succession under this Alternative would be identical to that found in Alternative G.

Recovery of Riparian Vegetation

This alternative would undertake recovery operations on 3.4 miles (includes 1.2 miles of test plots) the first year in order to determine the most effective techniques for successful riparian plantings. This recovery would be concentrated in two main drainages, Cook Creek and Cottonwood Creek An additional 20 miles of recovery planting would be undertaken as soon as reliable results from the first 3.4 miles of planting become available. If the first planting proves to be successful, the subsequent planting efforts would allow Cook Creek to recover to 97 percent of its pre-fire canopy cover level and Cottonwood Creek would recover to 96 percent of its pre-fire canopy cover level by 1998. Cherry Creek would recover to 100 percent of its pre-fire canopy cover level during this period. In the event that this planting proves to be unsuccessful and/or impractical, the riparian recovery would revert to its natural rate, which would mean that Cook Creek would recover to 88 percent of its pre-fire condition and Cottonwood Creek would recover to 73 percent of its pre-fire condition by 1998.

Long-term Operability and Fire Hazard

Not harvesting 383 acres of the DR/TM Allocation (compared to Alternative G) would make those acres non-operable or more difficult to operate because of the quantity, location and arrangement of dead and down timber. This would restrict the range of future management options. The large amount of unrecovered fire-killed timber would also continue to pose a long-term (up to 35 years) fire hazard over much of the fire area. Host material for bark beetles would remain. The result is decreased ability to perpetuate healthy stands of diverse tree species, sizes, and age classes, with far fewer vegetation management options available.

In comparison with Alternative A, salvage of timber from 2,701 acres of DR/TM land would have an indirect, but positive, effect on the reduction in fire hazard by removing large amounts of available fuel. The removal of the fire-killed timber would cause a positive increase in long-term operability. The salvage harvest and the increase in operability will provide more ability to keep damaging insect populations, particularly bark beetles, at reduced levels and facilitate the control of any outbreaks that may occur. The cumulative effect is increased ability to perpetuate healthy stands of diverse tree species, sizes, and age classes, with more vegetation management options available.

OTHER NEPA CONCERNS

Probable Adverse Environmental Effects That Cannot Be Avoided

Salvage of fire-killed timber may disrupt natural recovery on harvest units for approximately one year. Rehabilitation grass seeding done Fall 1988 to help prevent soil erosion has introduced non-native species that will persist for one to ten years. These grasses will compete with native species on a decreasing basis as time passes.

For all action alternatives, the amount and distribution of mature and old growth fire-killed and severely fire-damaged trees will be reduced on the harvest units.

All large-sized fire-killed trees on non-harvest areas will remain on the site and ultimately will fall to the ground within an approximate 20-year period. When volumes are large, this accumulation of down, woody debris will reduce land operability and may preclude many vegetation management practices for one to four decades.

The use of dead trees to provide wildlife habitat (cover) precludes salvage of this material and it soon deteriorates beyond merchantability. This use dissipates as the trees lose their needles, then their branches, and ultimately fall.

Irreversible and Irretrievable Commitment of Resources

Old growth forest stands, once burned or harvested, are considered an irretrievable loss. At least 200 years are required for a stand to develop old growth characteristics. Even without harvest activity, natural mortality from insects, disease, and fire reduces old growth. Left unmanaged, stand decadence may alter old growth sufficiently to set the vegetative structure back to an early successional stage. The result would be a natural change, or loss, of old growth.

TRANSPORTATION SYSTEMS

IMPORTANT INTERACTIONS

Public use of Forest resources, along with Forest Service use and protection activities, have both direct and indirect effects on the transportation system roads in the project area. Conversely, development of the transportation system has direct and indirect effects on other forest resources. Alternatives implemented which include development of a transportation system could have effects on resources within the project area, including wildlife habitat, visual quality, cultural resources, vegetation management, water quality, recreation, and others.

Impacts of the transportation system on these resources will be discussed in appropriate sections of this chapter. Roads within the Tepee Butte project area were built for the purpose of accessing timber, not to reach remote recreation areas. Some roads will be upgraded to facilitate future log haul and recreation access as part of the planned transportation system program. Trail access is addressed in the recreation section of this chapter.

EFFECTS COMMON TO ALL ALTERNATIVES

Whether new roads are built or existing ones continue to be used at the same rate, surfacing will be lost through use, resulting in chuck holes and other rough conditions. An increase in loss of road surfacing will occur as a result of increased use, which would mainly be attributed to timber harvest. The amount of road use determines the maintenance level.

The Chesnimnus Cooperative Road Closure will be in effect under any alternative. This closure is a cooperative effort on the part of the Forest Service and Oregon Department of Fish and Wildlife, using a green dot system to close roads during elk hunting season.

The closure will be in effect from three days prior to rifle bull elk hunting season through the closure of antlerless elk hunting season (about 24 days in November).

EFFECTS COMMON TO ALTERNATIVES G, H, AND J

Implementation of any of these action alternatives would require some road construction to access harvest units. As mentioned above, effects on specific resources is addressed in appropriate sections elsewhere in this chapter (including fire and fuels, energy, cultural resources, rapid timber recovery, vegetation management, site-productivity, fisheries, water quality, recreation resources, and visual resource).

Roads designated for removal from the transportation system would be barricaded in some manner to eliminate travel or they would be obliterated. Obliteration could be accomplished in one of two ways: totally reclaiming the road bed by pulling in the cutbanks and returning the land to a natural repose; or by use of a subsoiler such as a winged ripper to scarify the road bed and eliminate compaction.

1. A portion of the Wildhorse Roadless Area allocation designated in the FEIS and CMP in the Hells Canyon NRA was re-allocated by an Act of Congress and became part of the Dispersed Recreation/Timber Management (DR/TM) allocation. Some of the road construction within the DR/TM is in this previously roadless area. This includes a portion around Poison Point and Wildhorse Ridge.

2. Roads with non-native surfacing will be more expensive to maintain. Several Forest roads in the project area have some or all non-native surfacing:

   4600
   4680
   4690
   4625
   4600760
   4600780
   4600788

2. Road density (miles of open roads per square mile) will change following construction of new roads and deletion of others. See each alternative for specific miles of open and closed roads and resulting densities.

3. Specific roads closed, type of closures, maintenance levels, and road management objectives prescribed for each road under each alternative may be found in the Road Management Plan, Appendix K.

4. Rights-of-way for new road systems in salvage alternatives would require cutting a few green trees. Green volume will amount to less than 20 MBF (thousand board feet). The majority of the volume affected by rights-of-way are dead or severely damaged trees.

EFFECTS SPECIFIC TO EACH ALTERNATIVE (A, G, H, I, J, K)

Alternative A

1. Only current use is planned under this alternative. The existing transportation facilities are adequate; no reconstruction is planned.

2. No road construction is needed because there is no timber harvest to support. No existing roads will be removed from the transportation system and current uses will remain in effect. This will leave an open road density of 4.4 miles per square mile for DR/TM, 0.4 miles per square mile for DR/NV, and 0.3 miles per square mile for Forage.

3. No Forest roads will be upgraded.

4. The current pre-fire maintenance level will be retained: 2.9 miles of Maintenance Level 1 roads, 78.7 miles of Maintenance Level 2 roads, and 20.7 miles of Maintenance Level 3 roads.

Alternative G

1. The proposed haul route is over Forest Roads 4600, 4680, 4625, and 4690. All or a portion of these roads will be reconstructed to mitigate the wear caused by the hauling timber. This reconstruction is mainly in the form of surface rock replacement and shaping.

2. Timber harvest will require 3.9 miles of road construction. However, 12.4 miles of existing road will be removed from the transportation system. With implementation of the Road Management Plan, an open road density of 1.6 miles per square mile will result for DR/TM, 0.2 miles for DR/NV, and none for Forage. An additional 1.3 miles of temporary roads will be built; however, these roads will be obliterated after logging is completed.

3. Forest Roads 4680, 4625, 4690, and 4600780 will be upgraded through reconstruction to handle the volume of timber removed and improve public safety and recreation access.

4. After implementing the Road Management Plan for the project there will be 48.3 miles of Maintenance Level 1 roads, 20.6 miles of Maintenance Level 2 roads, and 24.4 miles of Maintenance Level 3 roads.

Alternative H

1. The proposed haul route is over Forest Roads 4600, 4680, 4625, and 4690. All or a portion of these roads will be reconstructed to mitigate the wear caused by the haul of timber. This reconstruction is mainly in the form of surface rock replacement and shaping.

2. Timber harvest support will require 2.7 miles of road construction. However, 12.4 miles of existing road will be removed from the transportation system. With implementation of the Road Management Plan, an open road density of 1.6 miles per square mile will result for DR/TM, 0.2 miles for DR/NV, and none for Forage. An additional 0.4 miles of temporary roads will be built;

however, these roads will be obliterated after logging is completed and will not add to the transportation system.

3. Upgrading of Forest Roads 4680, 4625, 4690, and 4600780 will be accomplished through reconstruction to handle the volume of timber removed, improve public safety, and improve recreation access.

4. After implementing the Road Management Plan for the project there will be 46.7 miles of Maintenance Level 1 roads, 20.6 miles of Maintenance Level 2 roads, and 24.4 miles of Maintenance Level 3 roads.

Alternative I

1. The proposed haul route is over Forest Roads 4600, 4680, 4625, and 4690. However, because so little salvage volume would be removed under this alternative, no reconstruction is planned as a mitigation for wear.

2. No road construction is needed for timber harvest. In addition, 11.3 miles of existing road will be removed from the transportation system. With implementation of the Road Management Plan for the project, an open road density of 2.4 miles per square mile will result for DR/TM, 0.3 miles for DR/NV, and none for Forage. No temporary roads will be needed.

3. Forest Road 4600780 will be upgraded through reconstruction to improve public safety and recreation access.

4. After implementing the Road Management Plan for the project there will be 22.9 miles of Maintenance Level 1 roads, 44.4 miles of Maintenance Level 2 roads, and 20.7 miles of Maintenance Level 3 roads.

Alternative J

1. The proposed haul route is over Forest Roads 4600, 4680, 4625, and 4690. All or a portion of these roads will be reconstructed to mitigate the wear. This reconstruction is mainly in the form of surface rock replacement and shaping.

2. Timber harvest activities will require 3.9 miles of road construction. However, 12.2 miles of existing road will be removed from the transportation system. With implementation of the Road Management Plan, an open road density of 2.0 miles per square miles will result for DR/TM, 0.2 miles for DR/NV, and none for Forage. An additional 1.3 miles of temporary roads will be built, however these roads will be obliterated after logging is completed.

3. Upgrading of Forest Roads 4680, 4625, 4690, and 4600780 will be accomplished through reconstruction to handle the volume of timber removed and to improve public safety and recreation access.

4. After implementing the Road Management Plan for the project there will be 41.0 miles of Maintenance Level 1 roads, 28.1 miles of Maintenance Level 2 roads, and 24.4 miles of Maintenance Level 3 roads.

PROBABLE ADVERSE ENVIRONMENTAL EFFECT THAT CANNOT BE AVOIDED

Road construction will have a long-lasting effect on the visual resource by changing the lines, color, texture, and vegetation along the road. Increased use causes wear on the roads. This wear can be mitigated by appropriate maintenance and reconstruction activities.

RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

Constructing roads, skidtrails, and landings will remove lands from productivity or reduce soil productivity by compacting and displacing topsoil. Temporary roads and skid trails can be treated to restore a measure of soil productivity by using a subsoiler such as a winged ripper to reduce the effect of compaction. Effects of landing construction will also be mitigated by using a winged ripper; however, there will still be some reduction in productivity. For a more detailed discussion of these effects, see the long-term site productivity section.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Although the overall supply of rock suitable for road surfacing in the analysis area would not be significantly depleted by any of the action alternatives, the use of rock is considered to be an irretrievable commitment of resources.

RAPID TIMBER RECOVERY

This section will display the effects and consequences of the various levels of timber salvage on the value of timber resource found in the Dispersed Recreation/Timber Management (DR/TM). It will show how much timber would be utilized and/or foregone in each alternative, given the particular level of harvest and the amount of timber that will be accessed. All alternatives are compared to Alternative G since this alternative treats the maximum amount of acres for vegetative recovery while meeting the CMP constraints for all other resources. The Recovery Information Chart near the end of this section shows the total volume of timber foregone due to both CMP direction and alternative themes.

IMPORTANT INTERACTION

Rapid timber recovery is of major significance both within the fire area and throughout the local community. For a detailed discussion of the value to be gained by the rapid recovery of the fire-killed timber, see Chapter IV, Economics section. Within 3-5 years the value of the timber would be almost totally lost to insects, rot and weathering.

EFFECTS COMMON TO ALL ALTERNATIVES

After completion of the Tepee Butte Fire Recovery Final EIS and award of salvage sale contracts, approximately one year will have passed since the Tepee fire. The pine species will have devalued approximately $150 per thousand board feet due to blue stain in the sapwood. There will be a 29 percent volume loss from wood checking and cracking in small trees and top logs of larger trees. (For more details on the deterioration process, the reader is referred to the Chapter III, Rapid Timber Recovery section, or Appendix A.)

The proposed volume to be sold with each alternative could be harvested in less than one year following award.

EFFECTS SPECIFIC TO EACH ALTERNATIVE

Alternative A

This alternative does not salvage any timber. Not harvesting the fire-killed timber within the DR/TM would represent an irretrievable loss of 27.5 MMBF (in comparison with Alternative G). Within 3-5 years after the timber dies, insect attacks, fungal infestations and weathering would render the timber virtually unmerchantable. Since the DR/NV and Forage Allocations are not part of the regulated timber base, the other 3.2 MMBF of timber harvested from the Forage Allocation in Alternative G is not considered a loss in Alternative A.

Alternative G

Under this alternative, 877 acres of DR/TM burned forest land would be artificially regenerated. The planting would include all of the timber-suitable acres within harvest units that are predicted to have a poor probability of success of natural regeneration. Planting would occur within five years of the logging.

Salvage logging would occur on a total of 3,353 acres. Of the 30.7 MMBF harvested, 3.4 MMBF is ponderosa pine, 10.4 MMBF is Douglas-fir, 1.3 MMBF is western larch, 14.5 MMBF is grand fir, 0.1 MMBF is lodgepole pine, and 1.0 MMBF is Engelmann spruce. The logging would probably occur in 1989 and 1990. The salvage operation would harvest all dead or severely damaged timber not needed to mitigate the effects of the fire on the soils, watershed, wildlife and visual resources.

The cumulative effect of rapid timber recovery would be to keep damaging insect populations, particularly bark beetles, at reduced levels by eliminating susceptible insect habitat and greatly minimize the risk of insect outbreaks.

Alternative H

Under this alternative 439 acres of burned forest land would be artificially regenerated. Of these, 269 acres would be planted without being logged and the remaining 170 planted acres would be salvage logged first. The 269 acres of planting occurs in the Forage allocation and would be planted in order to regenerate additional wildlife cover as quickly as possible. The planting would occur within five years of the logging.

A total of 911 acres would be salvage logged. This logging would occur only where it would benefit wildlife and none would be done in the Forage allocation. Of the 7.5 MMBF harvested, 0.7 MMBF is ponderosa pine, 2.8 MMBF is Douglas-fir, 0.1 MMBF is western larch, 3.6 MMBF is grand fir, and 0.3 MMBF is Engelmann spruce. The logging would probably occur in 1989 and 1990. This alternative would recover only about 27 percent of the merchantable, fire-killed timber that is available on DR/TM land.

There would be an irretrievable loss of 20 MMBF timber volume on DR/TM land with Alternative H. Within 3-5 years after the timber dies, insect attacks, fungal infestations and weathering would render the timber virtually unmerchantable.

In addition to the economic loss, the cumulative effect of less rapid timber recovery would be more difficulty in keeping damaging insect populations in check and preventing outbreaks.

Alternative I

Under this alternative no salvage units would be harvested, but 303 acres of burned forest land would be artificially regenerated. Removal of hazard trees around recreation sites and selected trail sections could produce an incidental amount of merchantable volume. Planting would occur in the first three years of the implementation plan on intensely burned (more than 50 percent mortality) visual foreground areas of Wellamotkin Drive (46) and Cold Spring Road (4680) with ponderosa pine and western larch to enhance the visual variety and stand structure of these foregrounds by controlling what species will return and where. Also proposed is the planting of selected recreation site foregrounds (camps, viewpoints, springs, etc.) with indigenous shrub species to enhance variety by adding color (aspen, redstem ceanothus, wildflower mix); spring bloom (Oregon grape, spirea); and wildlife use (serviceberry, willow, huckleberry).

Not harvesting the fire-killed timber within the DR/TM would represent an irretrievable loss of 27.5 MMBF. Within 3-5 years after the timber dies, insect attacks, fungal infestations and weathering would render the timber virtually unmerchantable.

The cumulative effect of standing timber volume loss and reduction in future growing stock, along with loss of productivity and restricted range of management options, may require recalculation of the allowable sale quantity for the Hells Canyon NRA over the next several decades. The cumulative effect of no rapid timber recovery coupled with no increase in operability would make it difficult to keep damaging insect populations from increasing to outbreak proportions.

Alternative J

Under this alternative 877 acres of burned forest land would be artificially regenerated within 1-5 years after the logging. Planting would take place in all of the suitable acres within harvest units that are predicted to have a poor probability of successful natural regeneration. In addition, 269 acres in the Forage allocation not logged would be planted to restore wildlife cover as quickly as possible.

This alternative salvage logs 2,701 acres. Of the 22.6 MMBF harvested, 2.5 MMBF is ponderosa pine, 7.4 MMBF is Douglas-fir, 1.1 MMBF is western larch, 10.7 MMBF is grand fir, 0.1 MMBF is lodgepole pine, and 0.9 MMBF is Engelmann spruce. The logging would probably occur in 1989 and 1990. Foreground areas along major travel routes and around selected dispersed recreation sites will not be logged.

In comparison with Alternative G, there would be an irretrievable loss of 4.8 MMBF timber volume on DR/TM land under this alternative. Within 3-5 years after the timber dies, insect attacks, fungal infestations and weathering would render the timber virtually unmerchantable.

The cumulative effect of the rapid timber recovery would be to keep damaging insect populations, particularly bark beetles, at reduced levels and minimize the risk of insect outbreaks.

ALTERNATIVE SUMMARY CHART

The following chart shows the outputs of each alternative in terms of volumes and acres.

Figure IV-12. Recovery Information Chart

		EFFECTS OF ALTERNATIVES				
ISSUES	ELEMENTS	A	G	H	I	J
RAPID RIVER RECOVERY	Land area salvage logged (acres)					
	DR/TM	0	3,084	911	0	2,701
	DR/NV	0	0	0	0	0
	Forage	0	269	0	0/A	0
	TOTAL	0	3,353	911	0	2,701
	Proposed harvest volume (MMBF)					
	DR/TM	0	27.5	7.5	0	22.6
	DR/NV	0	0	0	0	0
	Forage	0	3.2	0	0	0
	TOTAL	0	30.7	7.5	0	22.6
	Net volume NOT harvestable in NRA due to CMP Mgt. Direction (MMBF)					
	DR/TM	25.0	25.0	25.0	25.0	25.0
	DR/NV	70.8	70.8	70.8	70.8	70.8
	Forage	44.2	44.2	44.2	44.2	44.2
	Subtotal	140.0	140.0	140.0	140.0	140.0
	Net Volume NOT harvestable in NRA due to theme of alternative (MMBF)					
	DR/TM	27.5	0	20.0	27.5	4.8
	DR/NV	0	0	0	0	0
	Forage	3.2	0	3.2	3.2	3.2
	Subtotal	30.7	0	23.2	30.7	8.0
	Total net volume unharvested in NRA (MMBF)	170.7	140.0	163.2	170.7	148.0

OTHER NEPA CONCERNS

Irreversible and Irretrievable Commitment of Resources

All merchantable dead and severely damaged timber volume that is left unharvested represents lumber volume and value irretrievably foregone because it is allocated to other uses according to CMP direction. However, from a wildlife habitat or soil building standpoint unharvested dead timber is not considered a loss.

ECONOMICS

INTRODUCTION

In this analysis, economic consequences are a measure of the overall value of each alternative for managing the project area. The level and mix of goods and services available to the public vary by alternative, creating impacts on the social and economic environment. Results of the analysis of these impacts are presented in the form of **Important Interactions, Effects Common to All Action Alternatives,** and **Effects Specific to Each Alternative**. Analysis models and methods used to analyze the Tepee Butte Fire Recovery project management alternatives are presented in Appendix G.

The direct monetary results of the project impacts are discussed in terms of net cash value to the people of the United States, including the amount of Forest Service payments to the local counties and "direct" and "indirect" job opportunities.

In general, the monetary value (net cash value) of an alternative depends on the volume of timber harvested, the method(s) of harvest, the extent of road construction, the total number of acres reforested by hand planting, and the effect that these actions have on the number of big game hunting tags which will be issued for the area. The higher cost of helicopter logging and planting unroaded areas may be offset by the higher timber values recovered by helicopter logging.

Not included here are monetary values assigned to resources such as non-game wildlife, watershed, soils, scenic values, and fisheries, which do not vary among alternatives or to which values could not be assigned. Those specific items which were included in the analysis are timber harvest (timber sales); commercial mushroom gathering; various resource projects for watershed, recreation improvements, wildlife, and cultural resources; and big game hunting. The intention of this analysis is to show a relative measure of differences between alternatives based on direct costs and values used. Other resource values are discussed in other than monetary terms in appropriate sections of this DEIS.

IMPORTANT INTERACTIONS

1. Timber volume estimates

The estimated timber volume by alternative is based on net volume. The net merchantable volume was determined by using the stand examination data, which separated dead and severely damaged from green timber. The dead tree gross volume was reduced to a net volume by subtracting the top log, which would be lost due to checking (damage which results when wood fiber splits or cracks longitudinally from weathering) and additional decay. Estimates made for loss, including decay, averaged approximately 10 percent. An additional optional volume has been estimated and displayed but has not been included in any of the economic or social calculations made for each alternative. For further discussion of timber volumes and values, see Appendix G.

2. **Completion of salvage operations**

Any salvage operation is expected to be completed by the winter of 1989-1990.

3. **Revenues and costs**

Prices and costs assigned to other resources (e.g., timber, roads) are reasonable estimates of future resource values. Actual values may be different at the time of operation, but values used are considered reasonable estimates which reflect a relative comparison of costs and benefits among alternatives.

4. **Road costs**

Estimated road maintenance costs increase as the volume to be hauled increases. Various levels of construction and reconstruction and their associated costs are assigned to each road, depending on the volume it would be expected to accommodate under each alternative.

5. **Volume will count toward Allowable Sale Quantity**

Sawlog volumes will count toward the Wallowa-Whitman National Forest allowable sale quantity.

EFFECTS COMMON TO ALL ACTION ALTERNATIVES

For each action alternative, economic analyses include estimates of:

1) Present net value for a 10-year planning horizon, including salvage sales projected for 1989 and 1990;

2) Payments to counties from harvested timber volumes; and

3) Direct jobs and wage income generated from the timber sales program and other resource improvements in the project area.

Each project appraisal estimate is described below.

1. **Present Net Value**

The PNV includes the future benefits and costs of timber sales to be offered in the next year and the associated rehabilitation projects. All dollar estimates are discounted to 1989 dollars from the year that they are expected to occur. A discount rate of 4 percent was used throughout the analysis process. This rate is specified for use in the USDA FS Economic and Social Analysis Handbook.

2. **Payments to Counties**

The law requires that 25 percent of gross receipts from timber sales and user fees be returned to the counties in which they were collected, with the exception of the Timber Salvage Sales Fund (TSSF). For FY 1988 and 1989, Congress has directed that monies contributed to TSSF will also be shared with the counties, due to the large amount of timber burned on Forest Service lands during the past two years. It is not known if this practice will be continued into FY 1990 and beyond. In calculating the estimated payment to Wallowa County, the base rate appraised value was used with no bid premium added.

Adjustments in timber harvest levels on the rest of the Forest might be made. The agency can adjust harvest levels in two ways. The first method would be to reduce the ASQ (allowable sale quantity) for the effected area over the next few years so that total harvest does not exceed the long-term biological and physical capacity of the Wallowa-Whitman National Forest. An adjustment might be made because of the large volume of timber lost on commercial forest land as a result of the fire.

The second method of adjustment would be to grant contract term adjustment to the purchaser(s) of fire salvage sales for other previously contracted timber sales that may be held on the Forest. The intent of this action is to allow the purchaser to direct all of his efforts to removal of the distressed timber while it is still of commercial value. This can only happen if the purchaser has previously purchased other sales from a National Forest. Timber purchasers could also make an adjustment by voluntarily deferring harvest of sales they have under contract in order to harvest the burned timber immediately, with or without contract term adjustment. In either situation, payments to Wallowa County may not change significantly by adjustments to or delays in harvest elsewhere in the county.

3. Jobs and Income

Direct and indirect employment and income levels are difficult to estimate because of the interrelationship between output levels from the project area and output levels from the rest of the Forest. Jobs and income dependent on National Forest timber harvest could increase if salvage harvest is added to the normal level of sales in the market area. Conversely, employment and income would remain at normal levels if salvage harvest is offset by harvest reductions in other areas. Furthermore, any changes in harvest levels may be absorbed within current employment levels by adjustments in mill capacity or productivity. The purpose of the jobs and income listing for each alternative is to display the relative effects the alternative might have on the economy of the three-county area if that alternative were chosen, and to show the relative differences between alternatives.

EFFECTS SPECIFIC TO EACH ALTERNATIVE

In the following alternatives discussion, expected merchantable volumes of timber and PNV are presented. A detailed listing of revenues and costs by individual alternative is presented in Table G-5 in Appendix G. No attempt was made to evaluate the economic effect of the alternatives beyond 1999, due to the uncertainty of future allowable harvests in the project area.

Alternative A

No projects or activities are associated with Alternative A. Only receipts or costs which would occur as in the pre-fire condition were evaluated. No additional direct or indirect employment would result from this alternative. No consideration is given to future harvest of green timber from the area. Future timber harvest and expected yields are not analyzed for this project because it is not known how the Tepee Butte Fire will affect the ASQ for the Hells Canyon NRA. It is assumed that the ASQ for the Forest will not drop in the next 1-2 years if this alternative is chosen. It is also assumed that there will be no reduction in access for big game hunting. The Oregon

Department of Fish and Wildlife (ODF&W) will be reducing the number of deer and elk hunting tags which they will be issuing in the Chesnimnus hunting allotment.

Alternative G

Under this alternative an estimated 30.7 MMBF (optional 3.5 MMBF) of timber would be harvested, which would generate an estimated $293,000 in receipts to the Federal Treasury. The cost to implement this alternative would be $7,857,000 1/, of which $1,222,000 is needed to implement recreation projects and other resource recovery measures.

The PNV for the entire project would be $11,047,000 for the 10-year time period. The 25 percent payment to Wallowa County would be $73,000 or $2.38/MBF. An estimated 203 jobs of direct employment and an estimated 127 jobs of indirect employment are associated with this alternative. This is based on a 10-year time frame for all activities analyzed.

Alternative H

Under this alternative, an estimated 7.5 MMBF (optional 0.5 MMBF) of timber would be harvested, which would generate an estimated $72,000 in receipts to the Treasury. The costs to implement this alternative would be $2,699,000 1/, of which $881,000 would be needed to implement recreation projects and other resource recovery measures.

The PNV for the entire project would be $13,677,000 for the 10-year time period. The 25 percent payment to Wallowa County would be $18,000 or $2.38/MBF. An estimated 107 jobs of direct employment and an estimated 57 jobs of indirect employment opportunities are associated with this alternative. This is based on a 10-year time frame for all activities analyzed.

Alternative I

This alternative is much like the Alternative A in that no timber would be harvested. Only those areas which were identified for special planting activities would be treated. A total of $962,000 would be needed to implement this alternative, which includes recreation projects and other resource recovery measures.

The PNV of the entire project would be $13,613,000 for the 10-year time period. There would be no receipts returned to the Treasury and no payments made to Wallowa County. An estimated 80 jobs of direct employment and an estimated 37 jobs of indirect employment opportunities are associated with this alternative.

Alternative J

Under this alternative, an estimated 22.6 MMBF (optional 3.4 MMBF) of timber would be harvested, which would generate an estimated $215,000 in receipts to the Treasury. The costs to implement this alternative would be $6,309,000 1/, of which $1,329,000 would be needed to implement recreation projects and other resource recovery measures.

1/ Costs include timber sale implementation, recreation/resource rehabilitation/improvement projects, logging, and specified road development.

The PNV of the entire project would be $11,600,000 for the 10-year time period. The 25 percent payment to Wallowa County would be $54,000 or $2.38/MBF. An estimated 175 jobs of direct and an estimated 105 jobs of indirect employment are associated with this alternative.

None of the alternatives would create an economic situation where there would be significant, irreversible or irretrievable, cumulative or adverse consequences.

CONSEQUENCES ASSOCIATED WITH OTHER RESOURCES

CULTURAL RESOURCES

INTRODUCTION

Besides this chapter, cultural resources are discussed in Chapter III and Appendix I. The reader is referred to these sections for background information and additional details. In this chapter, the alternatives have been assessed by the magnitude and the types of proposed management activity and disturbance that could affect cultural resources in the project area. This section is divided into seven sub-sections. **Important Interactions** includes overall considerations regarding this resource and is followed by a sub-section, **Conditions Common to All Alternatives**. The sub-section, **Alternative A--No Action**, is presented as a point for comparison. **Effects Common to All Action Alternatives** is followed by some general effects not specific to particular alternatives. The section closes with detailed discussion of the four alternatives and the effects of each.

IMPORTANT INTERACTIONS

The cultural resources within the Tepee Butte Recovery Project area that are eligible for listing on the National Register of Historic Places can be reduced in value by any change in the quality of their historical, architectural, archaeological, or cultural character. The criteria for eligibility are listed in 36 CFR 60.4 and Section 101 (a)(1)(a) of the National Historic Preservation Act of 1966.

Other compliance procedures required under Section 106 of the National Historic Preservation Act must be observed. Consultation between the Wallowa-Whitman National Forest and the Oregon State Historic Preservation Office (SHPO) has expedited this procedure because of the special circumstances of this project.

A cultural resource inventory has been conducted following the Wallowa-Whitman National Forest's Stratified Inventory Probability System (SIPS; approved by SHPO) which prescribes the level of survey coverage required (see Appendix I). SIPS is based on the probability of finding a site.

This inventory identified 98 sites within the project boundary. On initial evaluation, most of these sites meet criteria for listing on the National Register of Historic Places (NRHP) and would be significant at local, regional, and some at a national level. All sites will be treated as potentially eligible for the NRHP until individually evaluated for eligibility for inclusion on this Register. There is a slight possibility that additional cultural resource sites will be found in the project area.

Under the four action alternatives cultural resources would be avoided, providing them with the level of protection necessary to assure their preservation. No adverse effect to NRHP eligible sites will be acceptable for this project. All potential effects will be mitigated.

Cultural resources are fragile and non-renewable. Any impact or alteration to a cultural resource is permanent and irreversible, whether it be adverse effects from a logging operation, or an intentional excavation of an archaeological site to recover scientific data.

Road construction, depending on its location, has moderate potential for encountering previously undetected archaeological sites. Timber salvage would have only low probabilities of unearthing additional prehistoric and historic materials, because these activities would be confined to areas where site potential is generally low.

Ground-disturbing activities and increased access to remote areas could potentially affect historic and prehistoric sites. Though low, the potential for disturbing cultural resources in the project area is greatest where road and trail construction and reconstruction, timber salvage, and site preparation activities are proposed. Cultural resources can also be affected by recreation developments and by people using the area for recreation.

Both the inadvertent discovery of unrecorded sites during project implementation and intentional data recovery excavations if needed for mitigation would increase knowledge about cultural resources within the project area.

Once discovered, all previously unrecorded cultural resources located during road building or timber harvest would be protected from further ground disturbance by provisions in the timber sale contract. Any sites discovered during project implementation, regardless of alternative, would be evaluated by a qualified cultural resource specialist for significance and mitigated through avoidance, monitoring, or data recovery, after appropriate consultation with SHPO and the Advisory Council on Historic Preservation.

The reviewer is referred to Appendix H for estimated costs of cultural resource projects not directly related to other resource activities. Cultural resource activities resulting from proposed recreation projects have been included under administrative costs in the section on Recreation in this chapter.

CONDITIONS COMMON TO ALL ALTERNATIVES

In the short term, reduced ground cover will make surface sites more visible. This will make these sites more susceptible to site theft and vandalism until vegetation grows back and obscures them from view.

Because the SIPS inventory design does not provide for coverage of the entire area, cultural resources may have been inadvertently overlooked or missed during survey. The inventory includes no subsurface testing; therefore any site which is not visible on the surface (including exposed vertical surfaces such as natural cutbanks and roadcuts) have not been discovered. They would only become evident through accidental discovery due to project-related earth movement or natural erosion exposing these sites.

Weathering of fire-exposed sites would accelerate for all alternatives. Increased erosion as a result of decreased ground cover may affect sites located along stream channels where mass soil movement may increase until vegetation re-establishes itself. Sheet and rill erosion at other sites susceptible to this type of action would be more vulnerable than pre-fire until vegetation is re-established. Grass seeding which has already taken place should reduce the immediate effects of erosion.

Alternative A - No Action

Because no activities are planned, cultural resources would remain undisturbed, except for the natural deterioration of sites over time. Weathering of fire-exposed sites would accelerate. Survey, inventory, evaluation, and mitigation of cultural resources may occur in the future in connection with other projects. The potential for site theft and vandalism would remain the same or diminish because new access would not be provided and trails closed by fallen logs would be less passable.

EFFECTS COMMON TO ALL ACTION ALTERNATIVES G, H, I, AND J

There are eight proposed activities which would have varying effects on all four of the action alternatives. The most complex activity from a cultural resource standpoint is a proposed data recovery plan to gather information from culturally scarred trees (cambium peeled trees) damaged or killed by the fire. This action would record data that would otherwise be lost in the short term to natural deterioration. This data would improve knowledge about the chronology, function, and method of peeling these trees, which would normally require sacrificing live, scarred trees. Trees would be selected which no longer meet eligibility criteria for the NRHP because of their damaged condition. This data collection opportunity, which would provide unique and beneficial scientific information, would be irreversibly lost through natural deterioration if not recorded through this proposed data recovery plan.

A proposed action also beneficial to cultural resources is the deletion through closure of about 12 miles of existing roads throughout the project area. As mentioned above, increased roading provides greater access to cultural resource sites and increases the potential for vandalism and site theft. All four action alternatives would eliminate about the same amount of roads and therefore are of equal benefit. The action would be of benefit as long as these roads remain closed, which is assumed to be a long-term, though reversible, action.

Neither normal nor heavy trail maintenance as proposed in the action alternatives would have direct impact on any recorded cultural resource sites (see Recreation sections). Therefore it is seen as non-impacting and not adverse. Indirectly, however, it will restore access to cultural resources isolated by the fire, particularly those in more remote areas, thus re-introducing the pre-fire level potential of site vandalism and theft, and, by improving access to these sites, potentially increasing damage to them. This action can be compensated by education of the public through signing and brochures, increased monitoring of the resource, and increased site protection surveillance. It is not anticipated that the effects will be significant enough to be adverse, though if monitoring detects resumed damage to the cultural resources along these trails, additional site protective action would be implemented.

Two hundred foot-wide buffers to be left along Class I, II, and III streams are proposed by three alternatives. This is to assure adequate water quality in salvage areas. No buffer would be necessary in the case of Alternative I because there would be no timber salvage. Indirectly, these buffers will serve as site protection measures for any unrecorded sites that may exist within these streamside zones. Similarly, all areas remaining undisturbed by any alternative will result in indirect protection of sites within them.

In all four action alternatives rehabilitation of the fireline and other disturbances related to fire suppression would be carried out. This will be done with light equipment which, nevertheless, would have the potential for disturbing unrecorded cultural resources. During the fire suppression efforts an archaeologist played an active role in deciding on the placement of firelines so that they would avoid cultural resources. The archaeologist also walked all tractor fireline during construction. Since that time, winter melt-off and spring rains may have exposed undetected artifacts signaling sites. Therefore, it is judged worthwhile to re-examine portions of these areas to take full advantage of the existing ground disturbance and assure that no undiscovered sites are further impacted by the fireline rehabilitation efforts. This constitutes a monitoring and precautionary measure with potential benefits of protection and preservation that would identify for protection any sites along this fireline not already located through the cultural resource inventory.

Recovery is planned for seven water sources in the project area. Several cultural resources are near these water sources, and unknown ones may exist. The magnitude of these projects will depend upon the extent of fire- and fire-suppression-related damage to each area. Because these water sources were previously developed, recovery efforts would be restricted to areas previously impacted, and no adverse effects are expected. Monitoring by cultural resource specialists during any earth moving activities would be necessary.

Another activity common in implementation but not in the number of sites to be treated is the rehabilitation of dispersed campgrounds. For Alternatives G and I, 12 major clusters and 62 scattered camp sites would be rehabilitated; for Alternatives H and J, the numbers are 11 and 52 respectively. These activities would require variable degrees of monitoring depending upon their proximity to recorded cultural resources. At the one site where a modern campground overlaps a prehistoric cultural resource, monitoring and restrictions on machinery would be stringent. At other locations where the prehistoric sites are distant or consist of single cambium peeled trees, monitoring would be employed and avoidance required, but restrictions on rehabilitation procedures would be commensurate with the potential for impacting each respective cultural resource site.

One more common element involves riparian shrub planting along selected streamsides in need of bank stabilization and erosion control. For Alternatives G and I, 23 miles of planting are proposed; for Alternatives H and J, 2.2 miles would be planted. All include an additional 1.2 mile set of test plots. The difference in magnitude is directly related to the expected difference in potential for affecting cultural resources, with the 23-mile set potentially affecting 5 locales, and the 2.2 mile set potentially affecting only one site near a spring. The nature of the activity, however, is such that the degree of impact to cultural resources, except at the test plots, would be extremely low, and, in fact, almost certainly be beneficial because it would decrease the potential for erosion. The planting intervals and techniques are essentially insignificant unless they occur directly within a rich archaeological feature. Inspection of the sensitive locales will result in site-specific recommendations for planting where impacts are anticipated.

Alternative G

Ground disturbing activities in this alternative could adversely affect cultural resources. There is a possibility of disturbance to sites from road and trail construction and reconstruction and timber salvage. Road reconstruction common to this alternative and Alternatives H and J would traverse a recorded prehistoric site presently bisected by a low standard road. Implementation of this alternative would require the site be tested and evaluated for eligibility for the NRHP. If eligible, that portion of the site where road reconstruction is proposed would be evaluated to determine whether any undisturbed deposits are present. If present, data recovery or other mitigation measures would be implemented. If data recovery were implemented it would result in a determination of no adverse effect.

With 1.3 miles of temporary road construction proposed for this alternative and Alternative J, there would be moderate potential for encountering unknown sites. If sites were found during construction they would receive some impact. Any adverse effects would be mitigated through data recovery, resulting in a net benefit of additional knowledge about the area's cultural resources. Increased access to once remote areas might also result in increased site theft and vandalism.

This alternative proposes no new trails, interpretive features, or trailhead relocations, but does include 5.9 miles of trail reconstruction, possibly increasing use to remote areas and adversely affecting cultural sites. Three of these trails are known to traverse significant cultural resource sites. Mitigation measures would be considered after field inspections on a case-by-case basis, with avoidance the preferred measure whenever possible by rerouting trail sections or rebuilding damaged trail tread with off-site fill. If avoidance is impossible, a data recovery plan would be prepared and implemented.

Proposed timber salvage under this alternative would encompass 3,353 acres to be logged using three different systems. In order of acreage covered they are: ground skidding, helicopter logging, and skyline cable. This alternative proposes 650 acres more salvage than any other action alternative, which means higher potential impacts to unrecorded cultural resources. There are three prehistoric lithic scatters and four cambium-peeled tree sites within proposed cutting units. These would be avoided and protected. The magnitude of potential effects is similar to that for Alternative J, with most of the sites being the same. Site preparation and planting is equal to that proposed for Alternative J with equal potential effect. These have variable potentials for discovering unrecorded cultural resources depending on the site preparation and planting methods. Any cultural resources discovered would be evaluated and mitigated as described above for road construction.

Alternative H

Road reconstruction common to this alternative and Alternatives G and J would traverse a recorded prehistoric site presently bisected by a low standard road. The site would be tested and evaluated for eligibility for the NRHP to determine if the further impacted portion would contain undisturbed deposits meriting data recovery or other types of mitigative measures.

With only 0.4 miles of temporary road construction proposed for this alternative, there is very low potential for encountering unknown sites. If sites were found during construction they would suffer some impact. Adverse effect would be mitigated through data recovery resulting in additional knowledge about the area's cultural resources.

In common with Alternatives I and J, 11 trailheads would be eliminated with no adverse effects. However, also in common, the consolidation of four trailheads at new locations and the relocation of three others would potentially discover unrecorded cultural resources.

The proposed 2 miles of trails built for recreation purposes would also increase access to remote areas to a slight degree as in Alternative J. The possibility of additional recreational use because of improved access may adversely affect cultural sites. This alternative also includes 13.2 miles of trail reconstruction which would increase access to remote areas.

Three of the trail sections proposed are known to traverse significant cultural resource sites. Mitigation measures would be considered after field inspections on a case-by-case basis, with avoidance being the preferred measure whenever possible by rerouting trail sections or rebuilding damaged trail tread with off-site fill. If avoidance is impossible, a data recovery plan would be prepared and implemented.

This alternative would salvage timber from 911 acres with site preparation and planting on a total of 439 acres, making it the alternative with the third lowest potential for impacts to unrecorded sites. Site preparation and planting have variable potentials for discovering unrecorded cultural resources depending on the methods used. Any cultural resource discovered during these activities would be evaluated and mitigated as described above for road construction. There is a single prehistoric lithic scatter site within one cutting unit which would be avoided and protected. Again, three different logging systems would be used.

As in Alternative J, five interpretive sites and one interpretive trail would be constructed. This raises the slight possibility of encountering unrecorded cultural resource sites, but this possibility is outweighed by the significant benefit these interpretive locations have for educating the public about the cultural resources and history of the region.

Alternative I

The proposed 7.1 miles of new trails built for recreation purposes would increase access to remote areas more than any of the other alternatives. In addition, the proposed 13.2 miles of trails reconstruction, as in Alternatives H and J, would further increase access. This increased use may adversely affect cultural sites. Three sections of trail reconstructions are known to traverse significant cultural resource sites, making them vulnerable to site theft. Mitigation measures would be considered after field inspections on a case-by-case basis, with avoidance the preferred measure whenever possible by rerouting trail sections or rebuilding damaged trail tread with off-site fill. If avoidance is impossible, a data recovery plan would be prepared and implemented.

In common with Alternatives H and J, 11 trailheads would be eliminated with no adverse effects. However, also in common, the consolidation of four trailheads at new locations and the relocation of three others would potentially discover unrecorded cultural resources. Under this alternative, the Eureka Mining Road would be rehabilitated to non-motorized trail, reducing impact to this historic linear feature.

This alternative proposes no timber salvage, but does include 303 acres of site preparation and reforestation planting. These activities have variable potentials for discovering unrecorded cultural resources depending on the methods used. Any cultural resource discovered during these activities would be evaluated and mitigated as described for road construction in Alternative H. Within one of the proposed regeneration units is a single lithic scatter which would be avoided and protected. The potential for impact to unrecorded cultural resources is lowest for the four action alternatives because of its minimal ground disturbing activities.

Unique to this alternative would be the construction of two new trailheads for the three interpretive trails and 11 interpretive sites. This increased recreational use because of improved access may adversely affect cultural sites. This raises the possibility of encountering undiscovered cultural resources which would require mitigation, but this low risk is overridden by the positive benefit these new trails and sites would have for interpreting cultural resources and historic events in the area. This would be a significant advantage over all other alternatives in this regard.

Alternative J

Road reconstruction common to this alternative and Alternatives G and H would traverse a recorded prehistoric site presently bisected by a low standard road. The site would be tested and evaluated for eligibility for the NRHP to determine if the further impacted portion would contain undisturbed deposits meriting data recovery or other types of mitigative measures.

With 1.3 miles of temporary road construction proposed for this alternative and Alternative G, there would be moderate potential for encountering unknown sites. If sites were found during construction they would receive some impact, and adverse effect would be mitigated through data recovery, resulting in additional knowledge about the area's cultural resources. Increased access to once-remote areas might also result in increased site theft and vandalism.

The proposed 2 miles of trails built for recreation purposes would increase access to remote areas to the same degree as Alternative H. More intensive recreational use because of improved access may adversely affect cultural sites. The 13.2 miles of trail reconstruction, also common to Alternatives H and I, would increase access to remote areas. Three sections of this reconstruction would traverse significant cultural resource sites. Mitigation measures would be designed after field inspections on a case-by-case basis, with avoidance being the preferred measure whenever possible by rerouting trail sections or rebuilding damaged trail tread with off-site fill. If avoidance is impossible, a data recovery plan would be prepared and implemented.

In common with Alternatives H and I, 11 trailheads would be eliminated with no adverse effects. However, also in common, the consolidation of four trailheads at new locations and the relocation of three others would potentially discover unrecorded cultural resources.

As in Alternative H, five interpretive sites and one interpretive trail would be constructed. This raises the slight possibility of encountering unrecorded cultural resource sites, but this possibility is outweighed by the significant benefit these interpretive locations have for educating the public about the cultural resources and history of the region.

This Alternative would salvage timber from 2,701 acres using ground skidding, helicopter, and skyline yarding systems. It has the second highest potential for impacting undiscovered cultural resources by this effect. There are three prehistoric scatter sites and five cambium-peeled tree sites within proposed cutting units. Trees would be avoided and protected unless selected for the cambium-peeled tree data recovery plan. This is very similar in this regard to the cultural resources present in Alternative G. As in Alternative G, reforestation would cover 877 acres, but 269 acres would be site preparation and planting unassociated with logging with variable potential for discovering unrecorded cultural resources. Any cultural resource discovered during these activities would be evaluated and mitigated as described above for road construction.

ENERGY

Fuelwood is the only energy source addressed in this discussion of the effects of alternatives. Fuelwood gathering is currently a low-impact activity in the Tepee Butte Fire Area. Fuelwood demand is relatively low, since Wallowa County is sparsely populated and the

best copy available

Tepee Fire area is approximately 45 miles from the closest small communities of Joseph and Enterprise, Oregon. No cumulative effects resulting from fuelwood collection are foreseen under any alternative.

The energy required to implement alternatives, in terms of petroleum products expended, is insignificant. This is because the amounts used are small in terms of the cost of procurement and the effect on National and world-wide petroleum reserves.

IMPORTANT INTERACTIONS

Fuelwood is a common form of home heating in northeastern Oregon. Most species of trees are used, although western larch, lodgepole pine and Douglas-fir are preferred. Fuelwood is obtained from the forest by cutting down dead trees or by collecting debris which remains on commercial timber sales sites.

Availability of fuelwood depends on existing supplies, road access, timber harvest activities, wildlife tree designations, and degree of regulation. Demand for fuelwood is primarily a function of quantity, quality, and availability, in relation to the distance from population centers and to the size of those population centers.

Currently, great numbers of fire-killed trees are within the project area. The fuelwood supply is potentially very great, although not all of this potential supply is available for fuelwood use.

In the DR/NV allocation, gathering of fuelwood is prohibited in most instances. Dead and down wood may be used for recreational campfires and administrative uses.

Unroaded portions of the project area are steep and inaccessible. This general characteristic limits fuelwood gathering opportunities for the general public.

The Chesnimnus Cooperative Road Closure precludes wood gathering along many roads in the area during part of the year. This closure limits vehicles (including wood cutters) to a few main roads during elk hunting season, to protect elk from excessive vehicular harassment and to maintain a quality hunt. The closure is effective from three days prior to rifle bull elk hunting season through the close of antlerless elk hunting season (about 24 days in November).

Dead trees provide valuable habitat for a variety of species of animals. Uncontrolled, indiscriminate cutting of standing dead trees for fuelwood can deplete the nesting and feeding habitats for these animals. Tagging wildlife trees for protection is a regulatory procedure used to maintain this habitat at prescribed levels established in the CMP. Another method restricts fuelwood cutting to within designated areas only. Prior to the fire, the public was allowed to gather fuelwood from the entire accessible portion of the DR/TM allocation. Administrative use sites and specially tagged or marked trees are excepted.

An indirect benefit of fuelwood cutting along open roads is realized in the removal of roadside hazard trees. Traveler safety is increased and administrative costs for clearing dead trees from the roadways are decreased.

Cable and helicopter logging operations can provide additional fuelwood in the form of cull logs, tree tops, chunks and pieces. Typically, this debris is available at log landing sites and adjacent to roads.

Although roadside fuelwood cutting has some benefits, and logging can result in additional fuelwood at the edges of the roads, there are some disadvantages from a visual resource management standpoint. Cutting of standing dead trees for fuelwood in the foregrounds of Wellamotkin Drive (Road 46) and Cold Spring Ridge road (4680) could result in the removal of trees left specifically to meet Visual Quality Objectives, as well as creating additional stumps and pieces of woody material. Some recreationists have the perspective that these impacts are unnatural and unsightly.

EFFECTS COMMON TO ALL ALTERNATIVES

As part of previous management activities within the Tepee Fire Area, sufficient wildlife trees were tagged for protection, to meet CMP direction and to protect the cavity-nesting habitat. Some of those tagged dead-wood snags in high-intensity burn areas were consumed by the fire or are scorched to the point they no longer attract wildlife species. Green, cull trees which were tagged for wildlife protection are more likely to have survived the fire, but in many cases may be scorched and somewhat less attractive to wildlife. In addition to the surviving (unburned) wildlife trees, the fire has created a great many fire-killed and severely damaged trees. The post-fire quantity of existing and potential wildlife trees is in excess of numbers prescribed in CMP management direction for snag-dependent species. Excess dead trees are potentially a source of fuelwood, but they may not be accessible. All alternatives have the mitigation measure which specifically requires that habitat for snag- and cavity-dependent wildlife will be maintained at 100 percent of habitat potential for all land allocations (see Chapter II). All action alternatives require that wildlife tree designation activities will be performed to meet this mitigation objective.

Effects Common to Alternatives A and I

Current fuelwood cutting practices would continue under this alternative. Road access would remain the same, because no new roads would be built to salvage harvest the fire-killed trees. Approximately 60 miles of open road would be available for fuelwood gathering access. Beyond the immediate edges of these open roads, little of the fire-killed timber would be available for public fuelwood cutting. Because there would be no helicopter or cable logging, additional fuelwood would not be transported from steep, inaccessible slopes to the road edge.

Effects Specific to Alternative G

Fuelwood would be available only in designated areas. Road access would increase for a short time with the construction of 3.9 miles of specified roads and 1.3 miles of temporary roads. Since all new roads are to be closed after use, this additional road access would only produce short-term access to fuelwood. After selected roads have been closed to meet wildlife protection objectives, there would be only 39 miles of open road available for fuelwood gathering access. Beyond the immediate edges of these open roads, little of the fire-killed timber would be available for public fuelwood gathering. Under this alternative, approximately 18.9 MMBF would be removed through cable and helicopter logging over 1,746 acres. As a result, there would be a great increase in fuelwood availability when woody material is transported from steep, inaccessible slopes to the road edge.

Effects Specific to Alternative H

Fuelwood would be available only in designated areas. Road access would increase for a short time with the construction of 2.7 miles of specified roads and 0.4 miles of temporary roads. Since all new roads are to be closed after use, this additional road access would only produce short-term access to fuelwood. After selected roads have been closed to meet wildlife protection objectives, there would be only 39 miles of open road available for fuelwood gathering access. Beyond the immediate edges of these open roads, little of the fire-killed timber would be available for public fuelwood cutting. Under this alternative, approximately 4.2 MMBF would be removed through cable and helicopter logging over 455 acres. As a result there would be an increase in fuelwood availability when woody material is transported from steep, inaccessible slopes to the road edge.

Effects Specific to Alternative J

Fuelwood would be available only in designated areas. Road access would increase for a short time with the construction of 3.9 miles of specified roads and 1.3 miles of temporary roads. Since all new roads are to be closed after use, this additional road access would only produce short-term access to fuelwood. After selected roads have been closed to meet wildlife protection objectives, there would be only 45 miles of open road available for fuelwood gathering access. Beyond the immediate edges of these open roads, little of the killed timber would be available for public fuelwood cutting. Under this alternative approximately 13.9 MMBF would be removed through cable and helicopter logging over 1,370 acres. As a result, there would be an increase in fuelwood availability when woody material is transported from steep, inaccessible slopes to the road edge.

FIRE AND FUELS MANAGEMENT

The reviewer is encouraged to read Chapter III, Vegetation Management, for a description of the various burn intensities.

IMPORTANT INTERACTIONS

In any analysis of the effects of fire on forest and range ecosystems, vegetation becomes a key factor because it is most immediately and directly affected by fire, provides the fuel for fire, determines conditions of fire hazard, and can vary considerably from place to place within an area. Those influences, in turn, can directly or indirectly affect all the resources found within the ecosystem.

Tepee Butte Fire ranged from low- to high-intensity burns, but the various burn intensities did not result in a typical mosaic pattern. In the high-intensity burn areas, several stands of trees may be killed but not consumed. Snags (dead trees in various stages of decay) eventually fall and create a large accumulation of fuels. In low-intensity fire areas, much of the burning is along the ground so fewer trees are killed and fewer fuels accumulate. Overall fuel loading is actually decreased because the smaller fuels are cleaned up.

Potential for high-intensity fires is greatest when growth of conifers creates crown fuels in close proximity to large accumulations of dead woody fuel. This condition can occur twice during the life of a stand. The first occurrence is during the early growing stages of a stand. A re-burn during this period may consume most of the woody fuel so that ensuing stands develop a low fire potential. The second condition occurs when the stand begins to break up and begins to accumulate dead surface fuels in the understory. Stand age for the second period depends on tree species longevity and can vary from 100 to 400 years.

The intensity of fire will also have a role in determining stand density and future fuels potential. For instance, a high-intensity fire will usually facilitate growth of a dense stand which will sprout in the new opening.

EFFECTS COMMON TO ALL ALTERNATIVES

At the rate at which snags are expected to fall, most snags in the burned area will be down within the next 40 years.

In the burn area, 12,617 acres were grass-seeded to prevent soil erosion and to provide site protection. Cured grass in late fall will increase the potential for fire starts, resulting in low-intensity fires with high rates of spread.

The probability of a similar fire occurring with the same intensity within the project area in the short-term (10 years) is low.

EFFECTS COMMON TO ALTERNATIVES A AND I

Listed below are effects associated with or resulting from implementation of these two no-harvest alternatives.

1. Fire-killed trees (snags) begin to fall within 2-5 years in the high- to moderate-intensity burn areas. Most snags will be down in 15 years, although some larger diameter snags will stand longer. In 25 years most fire-killed trees will become surface fuel, in contact with crowns of regenerated trees. At this time, fire in the concentrated ground fuels will present an increased resistance to control. However, resistance to control may not be increased as much on the high-intensity areas as in the moderate-intensity areas since down woody material material in the high-intensity area was more thoroughly consumed.

2. During the mid-life of the forest, (35-85 years following a fire), hazard is reduced as dead fuels decay and live tree crowns grow higher above the ground. When stands become overmature (different ages for different species, marked in hundreds of years) and decadent, dead fuels again accumulate, the likelihood of high-intensity fires increases.

3. Down material will assist with soil moisture retention and erosion control.

4. Down material will serve as a storehouse for nutrient supply. Heavier concentrations will act as fuel for subsequent fires.

5. The fire hazard will not increase on moderate- and high-intensity areas until most of the dead trees fall. By then, future ignitions would be harder to control. There would be little fire hazard in the low-intensity burn areas as a result of the fire.

6. No fuel treatment costs will be incurred.

EFFECTS COMMON TO ALTERNATIVES G, H, AND J

1. No mechanical site preparation is planned. If site preparation is needed in areas that had rehabilitation grass seeding immediately following the fire, it will only be done by hand scalping.

2. Any future fire hazard would be reduced in areas where salvage harvest is accomplished.

3. Fuel residue (slash from harvest activities) would be manipulated or re-arranged (piled, crushed, etc.) on a limited basis through mechanical means to meet resource objectives. Slash treatment is not prescribed universally for all salvage harvest units. Possible soil disturbance or compaction associated with limited logging slash residue treatment will be avoided. Fuel residue treatment would not serve as site preparation.

4. Slash lopping will keep residue on the site, aiding in retaining soil moisture. Scattered slash will also contribute to increased decomposition of residue.

5. Residue treatments that loosen or roughen the surface soil create some shaded micro-sites but also induce higher surface temperatures and soil moisture loss where mineral soils are exposed.

6. Removal of fuel residue allows more wind movement, which increases transpiration and desiccation of seedlings.

7. Fuel treatment with tractors can reduce shade and other protection afforded seedlings, and generally causes greater extremes at the micro-site level.

8. In areas where fuel residue will remain in place, seedlings will be protected from erosion raindrop splash, frost, and browsing animals. Heavier concentrations of slash could hinder seed catch (natural regeneration) and may impede hand planting of conifers.

EFFECTS SPECIFIC TO EACH ACTION ALTERNATIVE

Alternative G

Fire-killed or severely damaged timber would be harvested from approximately 3,353 acres under this alternative. Harvest will be accomplished with tractor over about 39 percent of the acreage, with helicopter over about 51 percent, and with skyline cable over the remaining 10 percent.

Of the proposed harvested acres, approximately 81 percent burned at moderate- to high-intensity. The remaining 19 percent of the proposed harvest area burned at low-intensity.

To meet visual quality and other resource objectives, the recommended fuel treatments under Alternative G are as follows:

- Mechanical slash manipulation on 8 percent of the acres as needed on a limited basis.
- Lop and scatter slash on 52 percent of the acres.
- Hand pile slash on 1 percent of the acres.
- Do not treat 39 percent of the acres (these acres burned with high- intensity or have low volume).

Estimated treatment cost = $26.79/acre

Alternative H

Fire-killed or severely damaged timber would be harvested from approximately 911 acres under this alternative. Harvest will be accomplished with tractor over 44 percent of the acreage, with helicopter over 47 percent, and with skyline cable over 9 percent.

Fire intensity on proposed harvest units ranged from moderate to high over approximately 95 percent of the area. The remaining 5 percent burned at a low-intensity.

To meet visual quality and other resource objectives, the recommended fuel treatments for Alternative H are as follows:

- Mechanical slash manipulation on 16 percent of the acres as needed on a limited basis.
- Lop and scatter 41 percent of the acres.
- Do not treat 43 percent of the acres.

Estimated Cost = $38.36/acre

Alternative I

Reforestation is planned for 303 acres under this alternative, but no timber would be harvested. No slash disposal would be needed and no associated costs would be incurred.

Alternative J

Fire-killed or severely damaged timber would be harvested from approximately 2,701 acres under this alternative. Harvest will be accomplished with tractor over approximately 38 percent of the area, with helicopter over approximately 48 percent, and with skyline cable over approximately 14 percent.

Of these proposed harvest acres, 87 percent burned at moderate- to high-intensity. The remaining 13 percent burned at low-intensity.

To meet visual quality and other resource objectives, the recommended fuel treatments for Alternative J are as follows:

-- Mechanical slash manipulation on 5 percent of the acres as needed on a limited basis.

-- Lop and scatter slash over 58 percent of the acres.

-- Hand pile slash over 2 percent of the acres.

-- Do not treat 34 percent of the acres.

Estimated cost = $27.55/acre.

MITIGATING MEASURES

In areas where tractor piling of slash would be performed, appropriate measures will mitigate possible compaction of soil.

OTHER ENVIRONMENTAL CHANGES

Wildfires are a probable adverse environmental effect that cannot be avoided. Their occurrence in and around the project area will be random in both time and space. Areas with the highest probabilities for ignition, however, can be identified. The intensity of fires will continue to be determined by site-specific factors such as fuel loading, weather conditions, and topography.

Treatment or lack of treatment of fuels residues in the short-term (0-10 years) will have little effect on long-term productivity.

There are no irreversible or irretrievable commitments of resources associated with treatment or lack of treatment of the fuels residues.

INDIAN RIGHTS

INTRODUCTION

This section addresses environmental consequences of the alternatives as they relate to Indian rights. It is presented in two parts: Indian Treaty Rights and American Indian Religious Freedom Act. Under each, the effects of the alternatives are discussed. For the purposes of this comparison, the baseline will be post-fire conditions unless specifically stated otherwise.

In the absence of reported religious sites within the project area, those alternatives favoring treaty rights would be most beneficial to Indians. None of the alternatives provides a clear preference for all aspects of Indian rights. The action alternatives involve management activities which usually directly benefit Indian treaty rights. Though these activities are not in direct opposition to Indian rights under the American Indian Religious Freedom Act, any activity has the potential for disturbing the privacy of religious practices.

INDIAN TREATY RIGHTS

The Nez Perce Indian treaty rights afford them certain privileges within their ceded treaty lands, which include the Tepee Butte Fire Recovery Project Area. The reviewer is referred to the discussion of these rights in Chapter III. Briefly, they include the right to take fish at all the usual and accustomed places, the privilege of hunting, the privilege of gathering roots and berries, and the privilege of pasturing horses and cattle on open and unclaimed land.

The reviewer is also referred to the Water Quality and Fisheries sections in this chapter and in Chapter III and to Appendices B and D for specific discussion of these aspects. For further information on availability of game animals, the reviewer is referred to the wildlife sections in Chapters III and IV. The privilege of gathering roots and berries relates to vegetation management and further information on the effects of the fire and subsequent consequences can be found in those sections of Chapters III and IV.

Important Interactions

The right to fish in the usual and accustomed places would benefit from recovery of fish habitat and water quality, and would be adversely affected by alternatives that degrade fish habitat and diminish the quality of the water.

Access to any usual and accustomed fishing places would be variably affected by road construction, reconstruction, and a limited amount of road closures as proposed.

The treaty-granted privilege to hunt is interpreted as relating directly to the wildlife resource. The availability of game animals within the project area would vary from pre-fire conditions.

Availability of certain traditional plant resources within the area was reduced by the fire. Regeneration of these plants will depend upon natural recovery; no alternative proposes planting to re-establish traditionally gathered roots or berries. Some plant resources, such as berries, may be more abundant after several years than prior to the fire because they represent earlier successional stages of a plant community, and the fire has reverted the land to these seral stages. It has been reported that Native Americans traditionally burned forested lands in order to promote wild berry yields. Where timber salvage is followed by tree planting, these young trees would soon compete with the berries and eventually dominate them, except in cases where berries form part of the later seral stages and climax growth.

Roots, on the other hand, may have been variably affected by the fire because they are generally found in open grasslands, meadows, and scablands which received lighter burn intensities. Most traditionally gathered root plants were dormant during this August fire. Time is required for any affected root resources to recover naturally. Because of the decreased canopy, root crops may become temporarily more abundant than pre-fire, until they are gradually replaced by later seral stages.

The privilege of pasturing horses and cattle on open and unclaimed land is a treaty right. The fire changed the range resource conditions and they will continue to change over the next few years (see Chapter I, Other Issues, Domestic Livestock Grazing and Range Condition). Aerial grass seeding of medium- and high-intensity burned areas and firelines was done in the fall of 1988 to re-establish vegetation and reduce soil erosion (see Chapter III, Water Resources, Watershed Rehabilitation, and Vegetation Management, Post-fire Conditions). The recovery of the range resource in the short term through the grass seeding and in the long term through natural regeneration would be the same for all alternatives. Therefore, all alternatives would have the same effects on the range resource as it relates to Indian rights. Additional information on range conditions will be collected over the next several years.

Environmental Consequences

All alternatives would achieve the same degree of water quality through different means; buffers along Class I, II, and III streams for Alternatives G, H, and J; and natural recovery in Alternatives A and I. Either 2.2 or 23 miles of riparian planting are proposed depending upon the alternative. Thus a direct benefit, the protection of fisheries resources, would result to all citizens including Indians, regardless of the action alternative selected.

Fish resources were affected by the fire and all action alternatives propose recovery in some degree. Alternatives G and I propose the greatest recovery efforts, including 23 miles of riparian planting, and therefore would be most beneficial for recovery from the present post-fire condition. Alternatives H and J, in proposing 2.2 miles of riparian planting would produce lesser benefits. The no-action Alternative A relies on natural processes to regenerate these critical fisheries habitats.

Alternatives G, H, and J, which promote the maintenance and re-establishment of big game cover, directly benefit all citizens including Indians. Alternative H with its emphasis on the recovery of elk habitat and other wildlife values would most directly benefit this aspect of Indian rights, whereas Alternatives G and J would benefit it directly, but to somewhat lesser degrees. Alternatives A and I both rely on natural succession, but Alternative I would have selected road closures; neither provide direct benefit to this aspect of Indian rights.

In terms of environmental consequences, none of the alternatives would have significant affects on the privilege of gathering roots and berries. Depending upon their locations, road closures in all action alternatives might reduce motorized access to these resources. Indirectly, those alternatives (G, H, and J) which propose road construction and reconstruction might provide greater access to traditional gathering grounds depending on their location, thereby providing some benefit to the Indians.

AMERICAN INDIAN RELIGIOUS FREEDOM ACT

The American Indian Religious Freedom Act specifically protects and preserves Native Americans' right of freedom to believe, express, and exercise their traditional religions, including access to sites. If sacred Indian religious sites exist within the project area, none have been reported. Efforts to identify sacred sites within the project area through contacts with the Nez Perce Tribal Executive Council resulted in none being identified to the USDA Forest Service. Increasing and improving the road and trail system could result in greater access to sacred sites. Though this could make these sites more accessible to the Native American religious practitioners who might use them, it could also increase access by non-practitioners, reduce privacy, and interrupt religious ceremonies and rituals. In the absence of identified sacred sites within the project area, none would be protected under any of the alternatives.

If sacred sites do exist within the project area, they could be impacted inadvertently by any of the action alternatives which propose varying degrees of ground disturbing activities. The greater the extent of disturbance, the greater the potential for impact. Increased activity from timber salvage operations, rehabilitation and recovery efforts, and facilities construction and reconstruction, could all have an indirect effect on this aspect of Indian rights because increased activity could produce a decrease in privacy. The practitioners may find this temporarily interrupts their use of traditional religious sites in the project area, until such time as recovery activities diminish.

Mitigation

If sacred sites subsequently are identified or discovered during the planning and implementation process, they will be avoided and protected in compliance with the American Indian Religious Freedom Act.

INSECTS AND DISEASES

Implementation of any alternative will subsequently affect forest health to some degree. These effects are described in the following three sections. The first section, **Important Interactions**, deals with background information, as well as introducing information that deals with the ensuing sections. The next section, **Analysis Criteria: Short- and Long-Term Pest Impacts**, describes the methods of evaluating differences between alternatives. The final section, **Effects Specific to Each Alternative**, describes the pest management implications under implementation of each alternative.

Reviewers should refer to the **Insects and Diseases** section of Chapter III, **The Affected Environment**. More detailed pest information is included in Appendix E concerning case studies, pest biology, probable problem pests, and specific management recommendations.

IMPORTANT INTERACTIONS

Both wildfire and management activities affect pest occurrence, populations and pest-caused damage. Various interactions occur between insects and diseases, pre- and post-fire stand conditions, and silvicultural treatments. Modifications to the land, either natural or man-caused, will affect a range of other systems.

The Tepee Butte Fire Recovery area consists mostly of mature stands with a moderately-large component of pest-susceptible, shade-tolerant species. Past management practices of salvage-only logging has tended to favor these species. Certain pests indigenous to these types of stands have proliferated. These pests include dwarf mistletoes and defoliating insects, and those that cause stem and root diseases.

Certain aspects of the Tepee Butte Fire have enhanced stand health. Most important of these was the direct result of killing a large percent of fire-susceptible grand fir while more fire-resistant ponderosa pine, western larch, and Douglas-fir were less severely damaged. In some areas, significant reduction in tree stocking may promote establishment of seral pest-resistant species. Oftentimes, intensity of dwarf mistletoe infection is reduced as the direct result of fire.

While silvicultural treatments will be limited to salvaging dead and damaged trees, post-fire stocking of healthy, undamaged remaining trees will dictate the level of regeneration that can be done. Regenerating stands that are in poor condition respective to forest health should be considered a desirable opportunity.

Fire-damaged Douglas-fir and ponderosa pine in areas with low- to medium-intensity ground fire are prone to attack by bark beetles. These are mainly scorched trees that may have some degree of cambium damage of the roots, root collar or lower bole. Such trees are stressed and susceptible to insect attack during the next beetle flight (spring-summer 1989) and in the next 3-5 years.

Epidemic populations of Douglas-fir beetle, flatheaded fir borer, western pine beetle, mountain pine beetle, and fir engraver are not expected to develop in the project area by multiplying in dead and damaged timber; thus, undamaged Douglas-fir and pine are not expected to experience significant levels of mortality by insect attack as a result of the fire. There is a low probability that an epidemic population will build in unsalvaged killed or damaged trees. It is thus imperative to monitor stands in the area for evidence of higher-than-anticipated insect brood production.

Pests commonly interact to reduce host vigor and cause mortality. Armillaria root disease and Annosus root disease are common in mixed conifer stands in the area. Stress caused by defoliators, root diseases, fire injury, drought, dwarf mistletoes, and other diseases will result in higher levels of damage. Bark beetles are attracted to weakened trees and if host vigor is sufficiently low, or if there are large enough numbers of attacking insects, mortality will result.

Generally, grand fir has increased as a component in most mixed-conifer sites, especially on those sites historically dominated by ponderosa pine, larch, and Douglas-fir, where frequent low-intensity ground fires removed later-successional grand firs. Management alternatives that maximize regeneration will allow the greatest opportunity to establish stand components that are less susceptible to pest-caused losses and develop stand conditions that are less conducive to pest-caused damage.

Long-term pest losses can be minimized by keeping stand components in early-seral stages of succession. Oftentimes, shade tolerant species need to be managed to meet resource objectives. In stands where grand fir will be managed in the future, the following recommendations are made:

1. Avoid wounding grand fir residuals and advanced regeneration. Stem decays and Annosus root disease can severely damage wounded grand fir. Fir engraver beetles, *Scolytus ventralis*, are often attracted to and associated with trees that have been injured and subsequently infected by organisms causing decays and Annosus root disease.

2. Minimize site disturbance, especially soil displacement and compaction. Root diseases, especially Armillaria root disease, can eventually result in severe losses to grand fir on disturbed sites.

3. Treat large, recently cut grand fir stumps (>18" in diameter) with a light coating of granular borax on the cut surface. This will prevent infection of *Fomes annosus*, cause of Annosus root disease.

ANALYSIS CRITERIA: SHORT- AND LONG-TERM PEST IMPACTS

Bark beetles and wood borers could cause substantial additional mortality if live fire-damaged trees are left in the project area. Only minor amounts of damage are expected to occur to green trees outside the project area, but potential hazard will be minimized by removal of fire-damaged trees. Damaged and stressed trees within the burned area are much more likely to be attacked by beetles. These are short-term impacts. They should occur within two to three years.

The alternatives have been analyzed according to the amount of potential insect habitat reduced through management activities. The principal indicator used is the number of acres of insect habitat reduced in areas that burned at moderate and low intensities. Long-term impacts, especially those that can be caused by diseases and defoliating insects, are also considered. These are likely to occur over the life of the stands. Generally these impacts are much harder to accurately predict and are best discussed in relative terms between alternatives. These impacts are considered highest in stands with a high proportion of grand fir, especially those that have been partially cut, and with a high incidence of dwarf mistletoe-infected Douglas-fir, where these components will continue to be managed.

Improved access due to road construction and reconstruction can enhance opportunity to effectively manage pest problems. Improving access to the area is therefore considered a benefit in alternative analysis.

EFFECTS SPECIFIC TO EACH ALTERNATIVE

Alternative A No Action

This alternative would result in the most detrimental conditions from a forest health standpoint. Under this alternative, the risk of post-fire pest problems is high and would likely remain so for years to come. With no salvage harvest of fire-stressed trees, there would be no level of insect habitat reduction and would therefore set the stage for substantial additional post-fire mortality of the Douglas-fir and pine components from bark beetles. The No Action Alternative also would permit the potential spread of bark beetles from fire-damaged stands into more lightly-burned areas as well as some adjacent green stands, unaffected by the fire. Clearly, this alternative could result in maximum loss of living trees from fire-mediated insect problems throughout the burn for the next 3 to 5 years. Insect populations and diseases would increase and decline naturally in accordance with the various influences and ecological relationships with other biotic (e.g., parasites, predators, and insect diseases) and abiotic (e.g., weather) components of the area that interact and determine the population dynamics of these organisms.

Over the short term (initial 3-5 years) bark beetle activity could be expected to increase in the low- and moderate-intensity burn areas and within certain green islands of trees within the burn or on the perimeter of the burn. Trees with any degree of cambial injury or damage to root systems, trees that are under stress from drought, or those weakened by disease or dwarf mistletoe are most susceptible to attack by bark beetles and woodborers within or on the perimeter of the burn. Bark beetles or woodborers are not expected to build up outside the project area in adjacent stands as a result of the beetle activity within the project area. Dwarf mistletoe infection would continue to increase under this alternative where no infected trees were removed.

Over the long term, although 57.3 MMBF of grand fir was killed or severely damaged by the fire, the improvement in forest health will likely be short-lived. Without subsequent appropriate long-term management of this component, this shade-tolerant climax species will eventually seed in and regain the dominant understory position it occupied prior to the fire in mixed conifer sites. The increasing component of this pest-susceptible species will lead to stand conditions favoring future pest-caused losses from stem decays, Armillaria and Annosus root diseases, fir engraver beetles, and defoliation by western spruce budworm and Douglas-fir tussock moth.

Implementing this alternative will have some irretrievable effects. Opportunity to salvage trees killed by the fire to recover wood fiber would be lost. Long-term degradation of stand health and diversity will result in stands where diseased and damaged grand fir remains and the Douglas-fir component is infected with dwarf mistletoe. The insect problems mentioned above would be promoted. Opportunities to treat such stands to improve forest health are foregone under the No Action Alternative.

Impacts sometimes associated with salvage cutting, such as site disturbance, compaction, and subsequent associated accelerated pest-caused losses, including stem decays and root diseases, will not occur.

Alternative G

This alternative will provide maximum opportunities to reduce insect habitat under the Hells Canyon NRA Comprehensive Management Plan (CMP). Under this alternative, 1,683 acres of the project area with low- to moderate-intensity fire will be treated, greatly reducing or eliminating the amount of insect habitat.

Provisions for long-term productivity and enhancement of diversity and stand health are also made. Salvage cutting of dead and damaged timber will recover usable wood fiber while allowing for regeneration in stands that burned hot enough to have substantial mortality. Maximum opportunities for managing species composition will occur over 877 acres that will be reforested by hand-planting conifers. Pest-resistant seral species can be readily established by this system. Additional acres of natural regeneration resulting from a shelterwood system will also enhance establishment of seral species.

Existing roads, as well as 5.2 miles of new roads will be used to access dead, damaged, and stressed timber. Opportunities for long-term pest control will be enhanced by construction of 3.9 miles of specified roads and 15.6 miles of reconstruction.

Closure of 12.4 miles of road would limit future opportunities to improve the health of stands accessed by these roads by limiting silviculture activities. Opportunities to use regeneration methods and conduct thinnings of regenerated stands to improve vigor and reduce susceptibility to bark beetle attacks would be severely limited or become operationally expensive past the closure.

Alternative H

This alternative will treat 911 acres by timber salvage. An additional 269 acres will be reforested. A silvicultural system of salvage logging of dead and damaged timber will be used. Silvicultural regenerative systems including logging, site preparation and hand-planting, will occur on 170 acres. The remaining 741 acres will be regenerated using residual timber as seed sources.

Insect habitat will be reduced on a total of 619 acres. Emphasis will be placed on stands and sites that are at highest risk for bark beetle-caused damage. Long-term forest health is not a specific objective of this alternative, yet it may be achieved on regenerated sites, totalling 439 acres. Remaining stands will be untreated or have salvage-only cutting which does not enhance stand diversity or health.

A similar amount of road construction and reconstruction exists among Alternatives G, H, and J. Similar benefits concerning accessibility will be realized for future pest management.

Alternative I

This alternative specifically addresses rehabilitating recreation resources in the short term. Stand health and diversity are not considered. Severely burned areas, as well as 23 miles of riparian zone will be regenerated. Only 82.7 acres of insect habitat will be reduced.

Implementing this alternative will have some irreversible and irretrievable effects. These consequences are: a. probable excessive mortality of damaged and stressed trees; b. trees killed by the fire not salvaged; c. long-term degradation in stand health and diversity where diseased and damaged grand fir remains and Douglas-fir is infected with dwarf mistletoe. Opportunities to treat such stands are foregone if not included in rehabilitation following a catastrophic event.

Impacts sometimes associated with salvage cutting, such as site disturbance, compaction, and subsequent associated accelerated pest-caused losses, including stem decays and root diseases, will not occur.

Alternative J

This alternative specifically addresses recovery of visual, wildlife and recreation resources. Maintenance or improvement in stand health and diversity will be accomplished over some of the area. The actual area receiving beneficial treatment is intermediate between Alternative G and Alternatives H and I. Insect habitat in the project area will be reduced on 1,450.5 acres that burned at low to moderate intensities.

Proposed road work and improved access is identical to Alternative G.

OTHER NEPA CONCERNS

Probable Adverse Environmental Effects That Cannot be Avoided

Under any alternative, insect activity will increase to one degree or another. Insect-related deterioration will commence in the spring of 1989 in any fire-killed timber that remains on the burn. This deterioration process will continue for as long as the wood provides a usable substrate for insect growth and development for the various insect species involved. Trees killed during the fire that remain on the burn under any alternative, are susceptible targets for insect attack in the first 2-4 years following the fire. Bark beetles, in particular, will attack and kill many of these injured trees, depending on the host species. Certain trees may resist attack and survive. Others will not be attacked at all. The level of attack and mortality or damage to trees will be directly related to the amount of available susceptible fire-weakened host for the insects. Any timely removal of injured trees in the moderate and lightly burned areas of the fire will reduce the amount of food material available to the beetles and ultimately limits the insect activity on the burn. Uninjured or lightly injured trees on the burn may provide a seed source for regenerating the site. However, selectively removing certain trees while leaving others, under a salvage alternative, risks injuring the residual stand and increasing the susceptibility to bark beetle attack. Damage to root systems and trunks of trees during logging activities can predispose these trees to disease and attacks by bark beetles in future years. Managing shade-tolerant survivors will probably allow the increase of dwarf mistletoe.

Relationship Between Short-term and Long-term Productivity

Long-term productivity may be affected either directly or indirectly through the activities of insects depending on the nature of short-term uses specified for the burn, over the next four years. In a no-action alternative, weakened trees that remain on the burn will have a direct influence on insect populations that are attracted to these trees. In some cases, insect populations that increase for a period to damage green trees on the site as well as those weakened by fire. These live tree attacks would not be expected to extend beyond the immediate project area. Populations would after a few years, decline to pre-fire levels or below.

Irreversible and Irretrievable Commitment of Resources

There are the loss of opportunities to manage pest-resistant seral species, as well as sanitizing stands in a no action alternative. This is especially true in those areas that did not have very much direct mortality from the burn.

MINERALS

None of the alternatives would affect mineral potential, rights, reservations, or withdrawals in the project area. Existing mining claimants would still be required to file a Notice of Intent or a Plan of Operation with the Forest Service prior to commencing any mining activity.

Because the Hells Canyon NRA is withdrawn from new mineral claim filing, any increased road access would not cause a corresponding increase in mineral exploration or development.

Direct effects on the mineral deposits within the project area would be minimal with any action alternative and would remain the same with no action.

PALEONTOLOGY

The reader is referred to the section on Paleontology in Chapter III, which discusses the low potential for fossil-bearing sites within the project area; none are believed to be unique sites nor to contain vertebrate species. No sites requiring protection have been identified within the project area, and research suggests that the potential for finding sensitive sites is very low.

IMPORTANT INTERACTIONS

Mass soil movement, erosion, and related natural weathering are two sided in their potential impact to this resource. These environmental changes have potential for destroying fossil localities, yet, may also have potential for exposing previously undiscovered sites. By the same token, alternatives that propose earth movement and other ground disturbing activities increase the possibility of both discovering unrecorded fossil localities and making them available for study or of destroying them.

EFFECTS COMMON TO ALL ALTERNATIVES

The alternatives that involve the greatest degree of ground disturbance, rock quarrying, construction of trails, roads, and other facilities have the greatest potential for affecting any previously unrecorded fossil localities.

As alternatives diminish in their amount of disturbance to subsurface environment, there is a concomitant decrease in the possible impact on paleontological sites. Alternatives, in decreasing order of potential of subsurface disturbance are G, J, H, I, and A with potential for affecting paleontological resources.

MITIGATION

In the event that fossil sites are encountered during project implementation, a qualified specialist will be called in to ascertain their significance, and if determined to be significant, the site will be avoided or mitigation measures will be taken.

THREATENED, ENDANGERED, AND SENSITIVE SPECIES

ANIMALS

IMPORTANT INTERACTIONS

The peregrine falcon and the bald eagle are the only Federally-listed endangered or threatened wildlife species known to be located within the Tepee Butte Project area. Species proposed for Federal listing (which are also Forest Service listed sensitive species) known to occur within the fire area are redband trout (*Onchorynchus* sp.) and Townsend's western big-eared bat (*Plecotus townsendii*). A Forest Service listed sensitive species known to occur within the project is the Lewis' woodpecker (*Melenerpes lewis*). A number of other species proposed for Federal listing and/or listed by the Forest Service which are suspected to occur in the area are ferruginous hawk (*Buteo regalis*), western yellow-billed cuckoo (*Coccyzus americanus*), Preble's shrew (*Sorex preblei*), spotted bat (*Euderma Maculatum*), wolverine (*Gulo gulo luteus*), North American lynx (*Lynx canadensis*), and Blue Mountains cryptochian caddisfly (*Cryptochia neosa*).

Monthly aerial surveys during January, February, and March 1989 of the Grande Ronde River north of the project area and the Snake River on the northeast boundary of the burn produced no bald eagle locations in the vicinity of this project. Anticipated bald eagle use of this area is limited to winter feeding and occasional roosting. There is no anticipated impact from this project, to this limited use by bald eagles.

An aerial survey of potential habitat has been completed for peregrine falcon nesting. Ground survey to identify if any current nesting activity is taking place is scheduled for April 1989 as part of project layout and preparation.

Subsequent seasonal survey, timed and designed for optimum detection, will be conducted annually with the intention of locating any peregrine nesting activities.

EFFECTS COMMON TO ALTERNATIVES G, H, J, AND I

There are no identified impacts of the proposed activities on specific critical sites or habitats of any of these listed species. Potential habitat may be altered for species not confirmed to occur within the potential project areas.

If any endangered, threatened, or sensitive species are confirmed to occur or have critical habitat within the project area under the selected alternative, activities which may disturb them will cease until the impacts can be fully analyzed and proper protection measures taken.

If any bald eagle observations are made during April through July in the project area, intensive nest surveys will be carried out. If a nest is located, activities will cease within 1 mile of the nest until the impacts can be fully analyzed in consultation with the U. S. Fish and Wildlife Service according to the Endangered Species Act (PL 93-205).

A biological assessment will be completed according to the Endangered Species Act (PL 93-205) to insure protection of peregrine falcons. Consultation with Oregon Department of Fish and Wildlife and USDI Fish and Wildlife Service is integral to the development of any biological assessment.

EFFECTS COMMON TO ALTERNATIVES G, H, AND J

One additional effect common to Alternatives G, H, and J may be the exposure of wolverines, a Forest Service listed sensitive species, to strychnine used to prevent gophers from damaging and destroying artificially regenerated trees. Wolverines have not been confirmed as occurring within the proposed project area in the recent past, although they have been recorded from a number of locations all around the project. The identified locations are well within reasonable travel range of wolverines. Wolverines are carrion specialists that may be reasonably expected to locate and consume poisoned gophers.

If wolverines are detected within or in immediate proximity of the project area and a decision has been made to use poison baiting for gopher control, this decision will be reassessed for the degree of risk and hazard. Oregon Department of Fish and Wildlife will be consulted in the development of a biological evaluation. Monitoring for non-target exposure and/or mortality will be integral to poison baiting of gophers.

SENSITIVE PLANTS

IMPORTANT INTERACTIONS

Sensitive plant species are those which are or could be in peril as a result of their limited populations, ranges, and vulnerability to natural or human-caused events. Ground disturbance and alterations of the light, moisture, and nutrient regimes within the forest and associated environments can affect sensitive plants and their habitats. In addition to the effects of the fire, implementation of recovery activities could affect sensitive plant populations within the project area. Road construction has the greatest potential impact on sensitive plants, since existing habitat in the road right-of-way is physically altered. On the other hand, effects resulting from timber harvest alone are considerably less intense than effects resulting from road construction, although a greater number of acres may be impacted.

There are four plant species of concern within the Tepee Butte Recovery Project area. Lace fern (*Cheilanthes feei*) is listed as endangered by the State of Oregon. The only sighting of this species in the vicinity of the project area has been at the mouth of the Imnaha River Gorge. Habitat for this species is on rock outcrops where moisture exudes and allows this fern to persist. There is a possibility that additional populations of this species may be found on suitable habitat within the canyons of Knight, Eureka, Cherry, Cottonwood, and other creeks in the project area. Probability of damage to this species by the fire is low because of the aqueous quality of its habitat.

Alumroot (*Heuchera grossulariifolia, grossulariifolia*), listed as sensitive and a potential candidate for the endangered list, is also of concern in the Tepee Butte Project area. This species has been sighted on Eureka Creek near where the fire ceased to burn with any degree of uniformity. Habitat is dry rock outcrops. This species more than likely occurs in areas which were unaffected by the fire because of lack of fuels.

The Sierra onion (*Allium campanulatum*) occurs on ridgetops in grassland plant communities. It has been found near a ridgetop in the Experiment Creek drainage at 3,650 feet elevation. Similar habitat for this species exists within the Tepee Butte Project area.

Another species of concern is minute phacelia (*Phacelia minutissima*), which is considered to be extinct. The only recorded sighting of this species on the Wallowa-Whitman National Forest was in 1934, in the vicinity of Buckhorn Springs. Subsequent searches around Buckhorn Springs have resulted in no new sightings.

EFFECTS COMMON TO ALL ALTERNATIVES

The majority of activities proposed under the action alternatives are concentrated in areas that do not contain suitable habitat for sensitive plant species. When activities might affect suitable habitat, surveys will be conducted to determine if populations of sensitive plants exist. If they do, management activities will not be conducted in those areas.

Since areas where populations of sensitive plants exist will be avoided, activities prescribed by the alternatives will not have any cumulative effects on sensitive plants.

OTHER CONSIDERATIONS

PROBABLE ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

Previous sections of this chapter have described numerous adverse effects which would be expected under the various alternatives. The following discussion summarizes the effects which would be expected under Alternative G, the proposed action. Implementation of Alternative G would inevitably result in some unavoidable environmental effects. Mitigation measures would serve to avoid or prevent most potentially adverse effects, but some resource damage could occur which cannot be completely mitigated.

Visual Resource

Under the proposed action, recreation visitors would see a visually modified forest in the foreground and middleground, where road construction and salvage harvest activities are conducted. These effects would eventually be eliminated by re-growth of vegetation.

Wildlife Habitat

The disturbance of wildlife during implementation of the proposed action is an adverse environmental effect that cannot be avoided. This disturbance will be caused by increased traffic which results from salvage harvest and other recovery activities.

Vegetation Management

Salvage of fire-killed timber may disrupt natural recovery on harvest units for about one year.

Within harvest units, the number of fire-killed and severely damaged old growth and mature trees will be reduced.

Wildlife habitat is provided by standing dead trees. A biologically appropriate number of "snags" will be left within the project area to protect and provide suitable habitat. This will unavoidably reduce the salvable volume of affected timber.

All large, fire-killed trees in areas not designated for harvest will fall within about 20 years. Accumulations of large woody debris will, in some areas, reduce land operability in the future.

Transportation System

Proposed road construction will have long-term effects on the visual resource by imposing artificial contrasts in form, line, color, and texture on the visual landscape. Permanent system roads will remove some lands from other uses.

RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

Long-Term Site Productivity (Soil)

Because much of the project area terrain is inaccessible to conventional vehicles, some soil damage which results from helicopter and cable logging operations will not be mitigated. However, effects of these harvest activities will be short-term and of limited magnitude.

Road and landing construction, and some logging activities will remove lands from productivity or reduce soil productivity through the compaction or displacement of topsoil.

The analysis period for monitoring soil erosion is 10 years. Mitigation measures implemented under the proposed action will help to maintain long-term site productivity.

Insects and Diseases

Depending on the nature of short-term uses which are planned for and conducted within the area over the next four years, long-term productivity of resources may be affected by increased insect activity. In areas which are not treated, weakened trees will attract insect populations. In some areas, insect populations will increase to levels which would threaten green timber as well as those trees which have been weakened by fire. Live-tree infestations would not likely extend beyond the project area. Experience has shown that after a few years insect populations would probably decline to pre-fire levels or below.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Recreation

Recreation developments included in the proposed action would require minor, irretrievable resource commitments on several sites throughout the project area. Resources near some dispersed campsites, water sources, interpretive viewpoints, trailheads, and trails would be affected. On these sites, potential timber and forage production would be foregone to provide recreation opportunities. For specific locations, reviewers can consult Appendix H, Recreation Projects.

Visual Resource

Active management in the recovery project area would result in modification of the natural landscape. Dead and dying trees would be salvaged and the natural stand structure and variety would be altered irretrievably. Scenic values can be maintained if future harvest in the area is postponed for approximately 20 years. In this time, vegetation will have recovered and a continuously textured, natural appearing landscape would again exist.

Roads built for short-term use under the proposed action would be obliterated and the scarified roadbeds seeded to recover a natural appearance over time. However, visible road scars will persist for a decade or more. Construction of proposed permanent transportation system roads would produce irreversible and irretrievable changes in the landscape.

Transportation System

Although the overall supply of rock which is suitable for surfacing roads within the project area would not be significantly depleted by the proposed action, the use of rock for road surfacing is considered an irretrievable commitment of resources.

Rapid Timber Recovery

Because some of the project area land is allocated to other uses under the Comprehensive Land Management Plan (CMP), some merchantable dead and severely damaged timber is not available for harvest. This timber represents woodfiber volume and commercial value irretrievably foregone. However, wildlife habitat and soil productivity gains are expected to result from the absence of management activity in these areas.

Cultural Resources

Any impacts or alterations to cultural resources are irreversible, whether they are inadvertent impacts to unrecorded sites, incidental to management activities, or designed archaeological excavations to recover scientific data.

If sites were impacted by proposed activities or were excavated using current techniques and methods, opportunities to use future, more sophisticated analysis techniques would be foregone. Such future methods might provide more or better data.

ENVIRONMENTAL EFFECTS UNCHANGED BY ALTERNATIVES

Recreation

Under all alternatives, recreationists would be subject to increased hazards at campsites and along trails and roads. Falling trees and unstable trail segments would pose some risk, until fire-killed timber is removed and trails are restored to and maintained at levels which meet current safety standards.

Water Resources

The fire caused adverse effects to water quality by increasing stream sediment and turbidity. These effects would not be changed by implementation of any alternative.

Environmental effects resulting from increases in snowmelt and rainfall-generated peakflows, increased stream temperatures, water nutrient losses, and decreases in dissolved oxygen, would not change under any of the alternatives.

Fisheries

Fire-induced environmental effects on fish populations would not be changed under any alternative. The fire has reduced fish populations; but natural recovery should start within three years. Pre-fire population levels will be approached within 10 years in both Cottonwood and Cook Creeks.

Wildlife Habitat

Fires typically increase the proportion of acres in early successional stages of vegetational development. Under all of the alternatives, the big game/forage ratio will remain unchanged. Within the project area fire has changed the ratio from 64/36 to 85/15. The optimum ratio is 60/40.

In the short term, wildlife populations (the total number of individuals per species) may decrease as a result of the fire. Until wildlife habitat is recovered, populations can be expected to sustain no further reductions under any of the alternatives. Viable populations would remain and populations would return to pre-fire levels when habitat has recovered.

Regardless of which management activities are implemented, primary excavator and cavity nester habitat will be more abundant in areas where trees are not salvaged.

As a result of the fire, approximately 90 percent of the mature, old growth forest areas no longer meet the criteria used to define old growth habitat. The 2,142 acres of old growth habitat which were not affected by the fire would remain untreated under any of the alternatives. Insects, disease, fire, and natural mortality affect old growth habitat. Left unmanaged, stand decadence may alter old growth in sufficient measure to return the vegetative structure to an earlier successional stage. This phenomenon would signify a natural change leading to a loss of old growth habitat.

Long-Term Site Productivity (Soil)

Within the project area, erosion (and subsequent effects on water quality) is primarily a fire-induced effect. Implementation of any of the alternatives would not measurably increase expected erosion.

Transportation System

A system of existing and proposed roads will be maintained to serve the needs of forest visitors and land and resource managers.

Cultural Resources

The fire destroyed historic cultural resources and affected some culturally scarred trees, resulting in a loss of data. Parts of some sites, particularly along streams, may be lost to erosion due to the fire's effects on the area's soils.

Until ground cover is re-established, some sites will be vulnerable to increased theft because they are more visible. Once vegetation returns and obscures these sites, their level of vulnerability will return to pre-fire conditions.

Regardless of which management strategy is selected, unrecorded cultural resources may be impacted by management activities.

Fire and Fuels Management

The potential for future wildfires is an environmental situation which would not be changed under any of the alternatives.

Indian Rights

Certain traditional plant resources (roots, berries and forage) were reduced by the fire. Some of these resources will recover quickly through natural processes. In the long term, natural recovery will restore or improve the others. There will be a reduction in hunting and fishing opportunities due to the fire, but conditions will improve, over time, under any alternative.

Insects and Diseases

Insect damage to fire-killed timber is expected in the project area during the Spring of 1989. Various insect species' populations will cause deterioration of woodfiber for as long as the wood substrate is suitable for the insects' growth and development.

SPECIFICALLY REQUIRED DISCLOSURES

Effects of Alternatives on Threatened and Endangered Species, and Critical Habitat

Regardless of which management strategy is implemented, protection of State and Federally listed Threatened and/or Endangered species will have precedence over land management direction. Surveys of potential peregrine falcon habitat, and monitoring of the redband trout population are planned.

The Forest will comply with all appropriate threatened and endangered species recovery plans. Provision is made in the recovery plan specific to each T & E species to pursue informal or formal consultation as necessary during analysis, project design, and project implementation.

No adverse effects on any Federally listed threatened or endangered species, nor on any known critical habitat are predicted to result from implementation of any alternative.

Effects of Alternatives on Prime Farmland, Range Land and Forest Land

All alternatives are in keeping with the intent of Secretary of Agriculture Memorandum 1827 for prime land. The project area does not contain any prime farm land or rangelands. "Prime" forest land does not apply to lands within the National Forest System. Under any alternative, National Forest lands would be managed with sensitivity to the effects on adjacent lands.

Energy Requirements of Alternatives

There are no unusual energy requirements for implementing any of the alternatives.

Effects of Alternatives on Minorities & Women

There are no differences among the alternatives in expected effects on American Indians, women, other minorities, or on the Civil Rights of any citizen of the United States.

Local consumers would be affected by the supplies of various goods and demands for services.

Effects on Wetlands and Floodplains

No significant effects on wetlands or floodplains are anticipated. The small size of bogs, ponds, and the wet areas adjacent to perennial streams will help facilitate compliance with Best Management Practices (BMPs). Buffer strips will be left adjacent to wetlands to mitigate any possible damage from salvage operations.

Intermittent stream floodplains are very narrow, a factor which will facilitate relative ease in applying BMPs within adjacent areas. No roads will be constructed across floodplains, nor will any roads cross perennial streams. The preventative measures, along with no-cut buffer strips, will mitigate any adverse effects to these areas. Varying degrees of riparian shrub planting proposed under some of the alternatives would enhance floodplains. All these measures conform to Executive Order 11990 for wetlands, and Executive Order 11988 for floodplains.

POTENTIAL CONFLICT WITH INDIAN TREATY RIGHTS

It is the policy of the USDA, Forest Service, Pacific Northwest Region to exercise its responsibilities to the American Indian. The Agency recognizes that Indian tribes are sovereign governments with powers, rights, and privileges which are parallel to and in some instances identical to State and county governments. Before Tepee Butte Fire resources recovery projects are implemented, Indian tribes will be consulted to ensure that planned actions are not in conflict with any treaty provisions.

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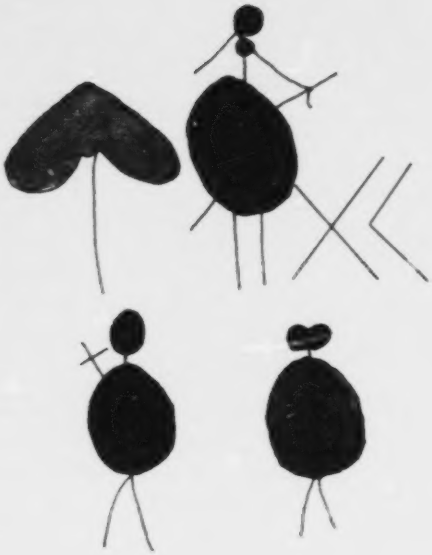


LIST OF PREPARERS

LIST OF PREPARERS

NAME	AREA OF EXPERTISE	EDUCATION DEGREE	YEARS EXPERIENCE
Steven W. Howes Project Director	Soil/Range Management	MS	16

INTERDISCIPLINARY TEAM

NAME	AREA OF EXPERTISE	EDUCATION DEGREE	YEARS EXPERIENCE
Lloyd L. Ames ID Team Leader	Wildlife Biology/Range Mgt.	MS	9
Steven L. Fletcher	Silviculture	BS	18
Marty J. Gardner	Logging/Transportation	BS	11
Tom Glassford	Recreation Management	BS	12
Richard Gritz	Fisheries Biology	BS	12
Dan Harkenrider	Soil Science	BS	12
Kenwood Hauter	Hydrology	BS	22
Gary Loeffler	Landscape Architect	MRP	21
Joanne Metzler	Hydrology	BS	7
Robin Rose	Recreation Planning	BS	9
Eric Siverts	Economics	PhD	9
Fred Strauss	Forest Management	BS	10
Rich Thurman	Wildlife Biology	BS	5
Richard D. Uberuaga	Fisheries Biology	BS	15
Jeffery B. Walker	Archaeology/Editor	MA	15

INTERDISCIPLINARY TEAM SUPPORT

NAME	AREA OF EXPERTISE	EDUCATION DEGREE	YEARS EXPERIENCE
Ralph Anderson	Wildlife Biology	AB	18
Darryl Gerber	Recreation	BS	5
Charles G. Johnson,Jr.	Plant Ecology	PhD	22
Arthur E. Kreger	Soil Survey	BS	19
Dave Lukens	Fuels Management	BA	19
Craig L. Schmitt	Forest Pathology	MFR	10
Donald W. Scott	Forest Entomology	PhD	14
Bill Smergut	Fuels Management		22
John Wagner	Economist	MS	5
Jerry Wilson	Landscape Architecture	BS	25
Bruce R. Womack	Archaeology	MA	12

DOCUMENT PREPARATION

Sue Arnott	Writer/Editor		1
Joanne Britton	Writer/Editor	MEd	14
Patricia Hinton	Map Coordinator/Graphic Art		14
Kathy Kilcoyne	Writer/Editor	BS	8
Dennis Patterson	Pacific NW Region Geometronics		
Verna Slane	Writer/Editor	BS	8
Paul E. Smith	Writer/Editor	AA	15
Rick Turnbull	Head Writer/Editor	BS	19

PUBLIC AFFAIRS

Gail Aschenbrenner	Project Public Affairs Officer
Marty L. Longan	Public Affairs Office, Washington, D.C.

COMPUTER TEAM (GEOGRAPHIC INFORMATION SYSTEM)

Jon McManus	Computer Support Leader

Deb Albright
Wanda Arriola
Kathryn Axton
Cathy Balfour
Elaine Bantam
Mike Barney
Mike Barrowcliff
Sonja Beebe
Michael Braymen
David Brock
Ken Burton
Darla Buxton
Laura Caposi-Kelly
Keith Carpenter
Norm Cimon
Ken Clay
Katie Countryman
Bill Disbrow
Bruce Erickson
Mike Erk
Pam Fahey
Shannon Ferl
Steve Fisher
Kathy Geddes
Del Groat
Dale Gunther
Kevin Gutierrez
John Hall
Tani Hoffman
John Kelley
Keith Kelly
Clada Kieser
Debbie Kroeger
Marge Landreville
Carol Logotide
Walt Lucus
Karol McGuire
Mike McKey
Bruce Meneghin
Brad Phillips
Mike Porter
Tim Quinn
Mike Reagan
Harry Richter
Jon Rollens
Dave Roschke
Debbie Sadler
Mary Schoborg
Lela Shiery
Colleen Springer
Laurie Smit
Ben Smith
Tom Smith
Deb Steele
Matt Turner
Sue Tripplett
Shelley Walker
Jeff Walter
Elaine Waterbury
Bonnie Zachary

SUPPORT SERVICES

Jan Davis	Business Management Assistant
Vicki Flesher	IDT Administrative Assistant
Billie Hutton	Business Management Assistant
Peggy Nickens	Logistics/Personnel
Cynthia Kuchenbecker	Business Management Assistant/Receptionist
Mary Ann Szymoniak	Assistant Project Manager/Logistics Coordinator

OTHER SUPPORT PERSONNEL

Gayla Brockus
Bev Connelly
Bob Cunningham
Michael S. Ferris
Lorrie Hill
Nancy Javins
Devin Nickerson
Vicki Medlin
Jimmy Roberts
Mark Sensibaugh
Zoe Spriet
Diana Sampson
Mary Brooks
Joyce Connor
Pat Davis
Suzanne Hanlon
Brenda Howerton
Tom Johnson
Greta Martin
Tom Pass
Tim Rutter
Dennis Spence
Priscilla Synan
Lauri Twiss
Tami Buchanan
Terri Cummings
Mark Fedora
Tanis Hester
Barbara Hung
Chris Leeper
Paula McBroom
Dale Pekar
Kathi Sayers
Ken Spence
Sheila Treanor
Dan White

CULTURAL RESOURCES CREW

Karen Brown
Anthony Keith
Phillip Minthorn
Jeff Walker
Mark Eastman
Dave Knudson
Dale Potter
Bruce Womack
Ed Keenan
Robin McClintok
Larry Taylor

DATA COLLECTION CREW

Elaine Bantam
Keith Carpenter
Brian Fischer
Jeff Kulon
Steve Rambler
Diane Schuldt
Ben Smith
Larry Wiechelman
Michael Bantam
Bruce Countryman
John Gerry
Fred LaChance
Geoff Reed
Pete Schuldt
Denise Wagg
David Brock
Ron Cummings
Dave Komlosi
Cynthia Maltbie
Laurel Rubin
Steve Sesnie
Larry Whittle

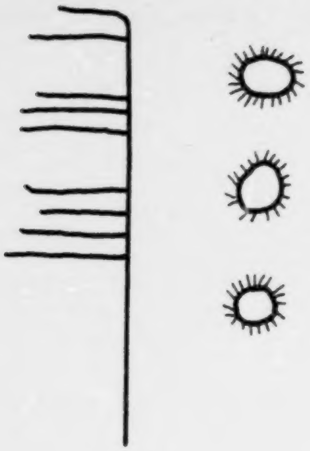
IMPLEMENTATION TEAM

Andrew W. James — Implementation Team Leader

Dana Allen
Jim Call
Barry Hansen
Fred LaChance
Torrie Smith
Sonja Beebe
Roger Garza
Steve Hawkins
Bill Nickell
Deb Steele
Mark Boucher
Tim Guilliam
Dave Jampolsky
Deb Sadler

ADMINISTRATION AND REVIEW

Kent Churchill	Pacific NW Region NEPA Coordinator
Ed Cole	Area Ranger, Hells Canyon NRA
Bill Gast	Deputy Forest Supervisor, Wallowa-Whitman NF
Bruce Kaufman	Timber Staff Officer, Wallowa-Whitman NF
Bruce McMillan	Planning Staff Officer, Wallowa-Whitman NF
Jocelyn Somers	Office of General Counsel, Portland



MAILING LIST

LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE STATEMENT HAVE BEEN SENT

Copies of the Tepee Butte Fire Recovery Draft Environmental Impact Statement (DEIS) and map packet have been distributed to the following government agencies, libraries, organizations, and individuals. Additional copies are available upon request at the Wallowa-Whitman National Forest Supervisor's Office in Baker.

FEDERAL AGENCIES AND OFFICIALS

- Advisory Council on Historic Preservation (ACHP)
- Agriculture, U.S. Department of (USDA)
  - Animal and Plant Health Inspection Service (APHIS)
  - Forest Service
    - National Forests (Region 6)
      - Colville - Colville, Washington
      - Deschutes - Bend, Oregon
      - Fremont - Lakeview, Oregon
      - Gifford Pinchot - Vancouver, Washington
      - Malheur - John Day, Oregon
        - Prairie City Ranger District - Prairie City, Oregon
      - Mt. Baker-Snoqualmie - Seattle, Washington
      - Mt. Hood - Gresham, Oregon
      - Ochoco - Prineville, Oregon
      - Okanogan - Okanogan, Washington
      - Olympic - Olympia, Washington
      - Rogue River - Medford, Oregon
      - Siskiyou - Grants Pass, Oregon
      - Siuslaw - Corvallis, Oregon
      - Umatilla - Pendleton, Oregon
      - Umpqua - Roseburg, Oregon
      - Wallowa-Whitman - Baker, Oregon
      - Wenatchee - Wenatchee, Washington
      - Willamette - Eugene, Oregon
        - Shady Beach Project, Oakridge, Oregon
      - Winema - Klamath Falls, Oregon
    - Office of the Chief, Washington, D.C.
    - Ranger Districts (Wallowa-Whitman National Forest)
      - Baker - Baker, Oregon
      - Eagle Cap - Enterprise, Oregon
      - Hells Canyon NRA - Enterprise, Oregon
      - Hells Canyon NRA - Lewiston, Idaho
      - Hells Canyon NRA - Riggins, Idaho
      - La Grande Fire Center - La Grande, Oregon
      - La Grande - La Grande, Oregon
      - Pine - Halfway, Oregon
      - Unity - Unity, Oregon
      - Wallowa Valley - Joseph, Oregon
    - Regional Offices
      - Region 1 - Missoula, Montana
      - Region 2 - Lakewood, Colorado

    - Region 3 - Albuquerque, New Mexico
    - Region 4 - Ogden, Utah
      - New Meadows Ranger District, New Meadows, Idaho
    - Region 5 - San Francisco, California
    - Region 6 - Portland, Oregon
    - Region 8 - Atlanta, Georgia
    - Region 9 - Milwaukee, Wisconsin
    - Region 10 - Juneau, Alaska
  - Office of Equal Opportunity (OEO)
    - Equal Employment Opportunity Commission, Washington, D.C.
  - Office of General Counsel (OGC)
    - Regional Attorney, Portland, Oregon
  - Rural Electrification Administration (REA)
    - Assistant Administrator for Management, Washington, D.C.
    - Environmental Policy Office, Washington,D.C.
  - Soil Conservation Service (SCS)
    - Environmental Coordinator of Ecology Sciences, Washington, D.C.
    - District Conservationist, Enterprise, Oregon
    - District Conservationist, Baker, Oregon
- Commerce, U.S. Department of (DOC)
  - National Marine Fisheries Service, Habitat Conservationist Division, Seattle, Washington
  - National Oceanic & Atmospheric Administration (NOAA), Ecology and Conservation Division, Washington, D.C.
- Defense, Department of (DOD)
  - Deputy Assistant Secretary of Defense, Washington D.C.
  - U.S. Air Force (USAF)
    - Deputy Assistant Secretary of the Air Force, Department for Environment Safety and Occupational Health, Washington D.C.
  - U.S. Army (USA)
    - Engineering and Housing Support Center, Washington, D.C.
- Energy, Department of (DOE)
  - Bonneville Power Administration
  - Office of NEPA Project Assistance, Washington, D.C.
- Environmental Protection Agency (EPA)
  - EIS Review Coordinator, Region 10, Seattle, Washington
  - Federal Agency Liaison Division, Washington, D.C.
- Federal Energy Regulatory Commission (FERC)
  - Environmental Quality Advisor, Washington, D.C.
- General Services Administration (GSA)
  - Environmental Staff, Washington, D.C.
- Government Printing Office (GPO)
  - Depository Receiving Section, Washington, D.C.
  - Receiving Unit, Laurel, MD
- Health and Human Services, U.S. Department of (HHS)
  - Departmental Environmental Office, Washington, D C.
- Honorable Les Aucoin, United States Representative
- Honorable Peter Defazio, United States Representative
- Honorable Mark Hatfield, U.S. Senator
- Honorable Robert Packwood, U.S. Senator
- Honorable Denny Smith, U.S. Representative
- Honorable Robert F. Smith, U.S. Representative
- Housing and Urban Development, U.S. Department of (HUD)
  - Region 10 Environmental Officer, Seattle, Washington

- Interior, U.S. Department of the (USDI)
  - Bureau of Land Management (BLM)
    - Office of the District Manager, Vale, Oregon
  - Director of Environmental Project Review, Washington, D.C.
- Interstate Commerce Commission (ICC)
  - Chief of Energy and Environment, Washington, D.C.
- Labor, U.S. Department of (DOL)
  - Assistant Secretary for Occupational Safety & Health, Washington, D.C
- Transportation, U.S. Department of (DOT)
  - Environmental Division, Washington, D.C.
  - Federal Aviation Administration (FAA)
    - Northwest Region, Office of the Director, Seattle, Washington
  - Federal Highway Administration
    - Region 10, Environmental Program Manager, Portland, Oregon
    - Office of Pipeline Safety, Washington, D.C.
    - Water Resources Coordinator, Washington, D.C.

STATE AGENCIES AND OFFICIALS

Gail Achterman, Office of the Governor, Salem, Oregon
Honorable Neil Goldschmidt, Governor, Salem, Oregon
Honorable Ray French, Oregon State Representative
Honorable Ray Baum, Oregon State Representative
Honorable Larry Craig, Idaho State Representative
Idaho Department of Fish and Game, Walt Brown, Boise, Idaho
Intergovernmental Relations Division, Clearinghouse Coordinator, Salem, Oregon
Oregon Department of Agriculture, Soil & Water Conservation Div., Salem, Oregon
Oregon Department of Fish and Wildlife, Baker, Oregon
Oregon Department of Fish and Wildlife, Corvallis, Oregon
Oregon Department of Fish and Wildlife, Enterprise, Oregon
Oregon Department of Fish and Wildlife, La Grande, Oregon
Oregon Department of Fish and Wildlife, Portland, Oregon
Oregon Department of Fish and Wildlife, Salem, Oregon
Oregon Department of Fish and Wildlife, Springfield, Oregon
Oregon Department of Forestry, Baker, Oregon
Oregon Department of Forestry, Salem, Oregon
Oregon Department of Forestry, Springfield, Oregon
Oregon Department of Forestry, Wallowa, Oregon
Oregon Dept. of Transportation,State Historic Preservation Office,Salem, Oregon
Washington State Department of Game, Habitat Management, Olympia, Washington

COUNTY AND CITY OFFICIALS AND AGENCIES

Baker, City of, Baker, Oregon
Baker County Chamber of Commerce, Baker, Oregon
Elgin Chamber of Commerce, Elgin, Oregon
Enterprise School District, Enterprise, Oregon
Joseph Chamber of Commerce, Joseph, Oregon
La Grande-Union Chamber of Commerce, La Grande, Oregon
Union County Commissioner, Marie Lester, La Grande, Oregon
Union County Court, La Grande, Oregon
Union County Planning Commission, Hanley Jenkins, La Grande, Oregon
Wallowa County Board of Commissioners, Enterprise, Oregon
Wallowa County Chamber of Commerce, Enterprise, Oregon

Wallowa County Judge, Pat Combes, Enterprise, Oregon
Wallowa County Road Department, Enterprise, Oregon
Wallowa Public Schools, Wallowa, Oregon

FOREIGN COUNTRIES AND DIGNITARIES

Consulate General of Japan, Seattle, Washington

PUBLIC LIBRARIES AND UNIVERSITIES AND COLLEGES

Baker Public Library, Baker, Oregon
Blue Mountain Community College Library, Pendleton, Oregon
Eastern Oregon State College Library, La Grande, Oregon
Eastern Washington University, JFK Library, Cheney, Washington
Enterprise Public Library, Enterprise, Oregon
Evergreen State College,Daniel J. Evans Library, Olympia, Washington
Humbolt State University, Office of the Dean, Arcata, California
Joseph Public Labrary, Joseph, Oregon
La Grande Public Library, La Grande, Oregon
Oregon State Library, State Library Building, Salem, Oregon
Oregon State University Library, Documents Division, Corvallis, Oregon
Oregon State University Library,Forest Engineering Dept., Corvallis, Oregon
Portland State University,Millar Library, Portland, Oregon
Seattle Public Library,Documents Section, Seattle, Washington
Southern Oregon State College Library, Ashland, Oregon
University of Idaho, Laboratory of Anthropology, Moscow, Idaho
University of Idaho, College of Forestry, Moscow, Idaho
University of Idaho Library, Moscow, Idaho
University of Minnesota, Forestry Library, St. Paul, Minnesota
University of Oregon Library, Eugene, Oregon
University of Oregon,Environmental Studies Center, Eugene, Oregon
University of Washington, Science and Engineering Library, Pullman, Washington
University of Washington,Suzzallo Library, Seattle, Washington
University of Washington,Forest Resources Library, Seattle, Washington
University of Washington, WEST-FORNET, Seattle, Washington
Wallowa Public Library, Wallowa, Oregon
Washington State Library, Olympia, Washington
Washington State University Library,Department of Agronomy and Soils, Pullman, WA
Washington State University, Holland Library, Pullman, Washington
Washington State University, Owen Science and Energy Library, Pullman, WA
Washington State University, Science and Engineering, Pullman, WA

NEWS MEDIA

Democrat-Herald, Baker, Oregon
Hells Canyon Journal, Halfway, Oregon
KLBM-AM/KREC-FM, La Grande, Oregon
KWVR, Enterprise, Oregon
La Grande Observer, La Grande, Oregon
Lewiston Morning Tribune, Lewiston, Idaho
Record-Courier, Baker, Oregon
Spokane Daily Chronicle, Spokane, Washington
Wallowa County Chieftain, Enterprise, Oregon

ORGANIZATIONS

American Fisheries Society
American Forest Council
Association of Oregon Loggers
Blue Mountain Resource Council
Blue Mountain Intergovernmental Council
Columbia River Intertribal Fish Commission
Confederated Tribes of the Umatilla Indian Reservation
Confederated Tribes of the Warm Springs Reservation
Friends of the Whitewater
Grande Ronde Resource Council
Hells Canyon Preservation Council
Idaho Environmental Council
Idaho Natural Areas Coordination Committee (Charles A. Wellner)
Imnaha Grange No. 677, Imnaha, Oregon
Issac Walton League, La Grande, Oregon
Lower Columbia Basin Audubon Society, Richard J. Leaumont
Mountain States Legal Foundation
National Forest Products Association
National Wildlife Federation
Nez Perce Tribal Executive Committee, J. Herman Reuben
Northwest Forestry Association, Wayne Ludeman
Northwest Timber Workers Resource Council, Ron Hedden
Oregon Natural Resources Council, Portland
Oregon Natural Resources Council, Prairie City
Oregon Trout
Our National Forest, Inc.
Pacific Northwest 4-Wheel Drive Association
Powder River Sportsman Club
Rocky Mountain Elk Foundation
Rocky Mountain Forest And Range
Rotary International
Sierra Club, La Grande
Sierra Club, Northern Rockies Chapter
Union County Economic Development Corporation
Union Commercial Club
Wallowa Resources Council
Washington Native Plant Society
Western Forest Industries Association
Western Forestry And Conservation Association, Richard Zabel
Wilderness Society
Wildlife Society of Oregon

Businesses

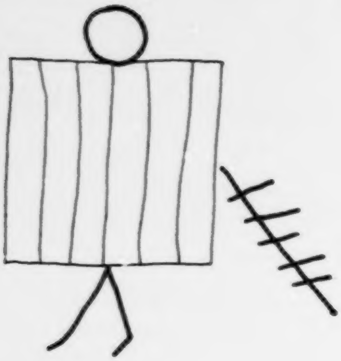
Boise Cascade Corporation, Kirk R. Ewart
Boise Cascade Corporation, Robert Messinger
Boise Cascade Corportation, Jim Spicer
CHEC
Crisstad Enterprises, Inc
Dougherty Logging, Doug Dougherty
Ellingston Lumber Company, Gary L. Johnson
Farris Insurance Agency, Inc.

Half-Baked Enterprises
Idaho Power Company, Allan R. Ansell
Idaho Timber Corporation
Lew Brothers Tire Service
Peacock Lumber Company
Rogge Wood Products, Inc.
Snake Dancers Excursions
USAC Mining Division

INDIVIDUALS

Adams, Tom
Anderson, Charles
Arnott. Sue
Aronin, Elliot and Pricilla
Aschenbrenner, Gloria
Aschenbrenner, Steven L. and Loretta
Aschenbrenner, William and Rita
Axton, Kathryn
Bahn, Bonnie
Bailey, Ric
Barry, John Mr. & Mrs.
Bates, Roberta
Beard, Leo
Beggs, L.
Bohannon, Michael
Botts, Cassandra
Brockhaus, Robert
Brown, Jim
Brownell, Edmund G. and Jean T.
Bush, Richard
Christman, Larry L.
Clapp, Dr.David E.
Collier, Linda
Combes, Raymond and Patricia
Compton, Charles
Cook, T.H.
Cotton, Roy E.
Cox, David R.
Cribbs, Larry
Crockett, Kate
Danielson, Rochelle
Dawson, Carmen
Dockweiler, C.E
Dorian, Thomas
Dougherty, Doug
Dyer, Crystal
Edvalson, Terry
Edwards, Cecil L.
Ellingson, Virginia D.
Eppenbach, Wayne
Fortenberry, Derv J.
Garoutte, Dale and Helen
Garrigus, Forest O. Jr.
Garten,Ray
Gaskins, Wayne
Gerl, Bob
Gerl, Gary
Gekeler, Doris
George, William G.
Gilbert, Dorothy S.
Glassford, Tom
Goebel, Mary A.
Haglund, Mike
Hall, Wade
Hamilton, Larry L.
Hatton, John
Hemstreet, Mark
Henderson, Elwayne
Henderson, James E.
Hickey Jerolee
Hierath, R. Dennis
Higgins, Mike
Honeyman, Bruce
Hudson, Steve
Hughes, Loren
Hustafa, Jerold
Ice, Dr. George
Isley, Arleigh
Jackson, Glade
Jackson, Glade A.
Jackson, Robert H.
Johnson, George A.
Johnson, Greg
Kaesmeyer, Cliff
Kellerman, Debbie
Kelly, Keith
Kerr, Andy
Kolva, Bob
Kono, Robert H.
Kostol, Carl R.
Kushara, Mr.
Lathrop, Bernice C.
Lathrop, C.E.
Lathrop, Joan
Lenox, Stanley J.
Leonard, John M.
Lillebo, Tim

Logsdon, Carol
Lovell, Skip
Lowden, Merle
Lowery, Odos
Markham, Ed
Marshall, Lyle
Mattson, Dan
McAllister, Michael
McCullough, Dale
McFetridge, Gary
McKague, Elizabeth
McMillen, Lloyd
McMillen, Vernon
Meehan-Martin, Paul
Merlich, Max
Messinger, Robert
Meyn, Margaret
Miller, M.W.
Miner, Gregory J.
Minthorn, Phillip
Moen, Stephen A.
Moore,Fitz-Randol.
Morehead, Michael E
Morehead, Paul
Morgan, Paul
Nagley, John
Naughton, Vince
Oberteuffer, W.H.
Oester,Paul
Olson, A.B.
Partridge, Diane
Patawa, Elwood
Perkins, Lee
Plough, Irving L.
Powell, David
Poyser, Gail
Pratt, Morris
Puckett, Dean
Puderbough, Milo
Reid, James
Reinhart, Troy
Reynolds-Ward,Joyce
Roberts, John W.
Rogers, John
Rompa, Bill
Roufs, R.
Roumpf, Larry
Rubin, Laurel
Ruonavaara, Russ
Russell, Bob
Sanders, Roger
Schroeder, Forrest
Schulz, Eric E.
Scott, William H.
Shriner, David R. Suzie
Simmons, Mark
Sines, Roy
Slinker, Al
Sorweide, Robert K.
Sowers, A.E.
Spicer, Jim
Stangel, Dick
Steffenson, John
Taylor, Charles A.
Taylor, Loreing E.
Tedder, P.L.
Teilmann, Harry
Tepfer, Sanford S.
Testermann, Steve F.
Thomas, Dorian
Tippett, Casey
Tippett, Donald G.
Toman, John V.
Turner, Darlene
Vojta, Scott
Voight, Patrick
Wagner, Richard A.
Walker, Jeff
Walker, Keith W.
Ward, Alvin
Ward, James D.
Warren, Jeffery
Warrener, Jim
Wells, E.R.
Werdinger, Leon
West, Gordon
Whitney, James L.
Wick, Ken
Wiedeman, Mike
Wiggins, Bob
Wilcox, Lewis and Bonnie
Williams, Ken G.
Williams, Randy
Wilson, Bob
Wilson, Sally
Wisbeck, W.T.
Wise, Ron
Witty, Ken
Woodruff, Kent
Wortman, Kenneth
Wortman, Pat and Judy
Young, Dale



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GLOSSARY

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A

Abiotic - Not involving or produced by organisms.

Activity - The work processes or management practices that are conducted to produce, enhance, or maintain outputs or achieve administrative and environmental quality objectives. An activity can generate multiple outputs.

Aerial Logging - A timber yarding system employing aerial means, e.g., balloons or helicopters, to lift the log or logs.

Affected Environment - The natural, physical, and human-related environment that is sensitive to changes due to proposed actions.

Age Class - The average of the timber stand in decades.

Airshed - A geographical area that, because of topography, meteorology, and climate, shares the same air.

Allocated Funds - Those funds transferred to the Forest from other agencies (including those from the Land and Water Conservation Fund, the Department of Labor, and the Soil Conservation Service) or provided from the K-V, Brush Disposal, Co-op Road Maintenance, or Purchaser Road Credits accounts.

Allocations - See - Dispersed Recreation/Native Vegetation
- Dispersed Recreation/Timber Management
- Forage
- Scenic River Corridor

Allowable Sale Quantity - The quantity of timber that may be sold from the area of suitable land covered by the Forest Plan for a time period specified by the Plan. This quantity is usually expressed on an annual basis as the "average annual allowable sale quantity." (It is the same as total chargeable volume.)

Alluvial Fans - A dynamic body of unconsolidated material deposited by running water, including sand, silt, clay, and various mixtures of these, whose surface forms a segment of a cone that radiates downslope from the point where the stream emerges from a narrow valley into a plain.

Alternative - A mix of management prescriptions applied to specific land areas to achieve a set of goals and objectives. The alternative provides management direction for the proposed project.

Anadromous Fish - Species which migrate from salt water up rivers and streams to spawn at their place of birth, e.g., salmon and steelhead trout.

Animal Unit Month (AUM) - The quantity of forage required by one mature cow (1,000 lbs.) for the equivalent of one month.

Antiquity - The quality of being ancient or old.

Artifact - Any object made by human work.

Available Forage - The amount of forage which may be removed without adversely affecting the vigor of the forage plants. (Normally considered to be about 50 percent of a grass plant.)

B

Basal Area - The cross sectional area of a tree usually measured at breast height (4-1/2 feet above ground). Basal area can be determined for one tree or all trees on an area. The basal area per acre is a measure of the density of the tree growth on that acre measured in square feet.

Baseline Data - Data representative of a particular base period of time or of a fixed location.

Bedload - Course rock material moved by streamflow. The movement occurs along the bed or close to it and for the Tepee area is defined as being composed of rock of gravel size (2.0 mm) and larger.

Beneficial Use - A use of stream water that is specified by Oregon as being significant somewhere within a large drainage basin. These uses include, but are not necessarily limited to, domestic, municipal, agricultural, and industrial supply; power generation; recreation; esthetic enjoyment; navigation; and conservation and enhancement of fish, wildlife, and other aquatic resources.

Benefit - Inclusive terms used to quantify the results of a proposed activity, project or program, expressed in monetary or non-monetary terms.

Best Management Practices - Best Management Practices (BMP's) are defined as "methods, measures, or practices selected by an agency to meet its nonpoint source control needs. BMP's include, but are not limited to, structural and nonstructural controls, operations, and maintenance procedures. BMP's can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (40 CFR 130.2, EPA Water Quality Standards Regulation).

Big Game - Large mammals hunted for recreation or meat; refers to elk, mule deer, and cougar.

Biologically Unique - Species which are not endangered but have considerable scientific, local or national interest.

Biotic Activity - Refers to the activity of soil organisms in the process of breaking down organic matter and releasing nutrients into plan usable forms.

Board Foot - A volume of solid wood, one foot square and one inch thick.

Breakland - Slopes in excess of 60 percent.

Buffer - An area where activity of a specific type is prohibited; this is contrasted to a special precaution zone in which a specific type of activity is limited, not prohibited.

C

Capability - The ability of the land unit to sustain certain activities with acceptable environmental consequences.

Carrying Capacity - Amount of use which will allow for the perpetual maintenance to a predefined degree of ecosystem, physical, and environmental quality, within management objectives, and at a level which will provide resource user satisfaction.

Catch Basin - A structure built to collect water and sediment. Typically a basin is designed to allow settling of sediment such that clean water flows from the outflow, or water evaporates or percolates into the ground leaving entrapped sediment behind.

Characteristic Landscape - The naturally established landscape within a scene or scenes being viewed.

Character Type - (Also Landscape Character Type) An area of land that has common distinguishing visual characteristics of landform, rock formations, water forms, and vegetation patterns. Character types are used as a frame of reference to classify physical features of a given area as to their degree of scenic quality (see Variety class).

Chesnimnus Cooperative Road Closure - (Green Dot Closure) Road closures that restrict motorized use three days prior to rifle elk season until the close of antlerless elk season. The objectives of the closures are to protect soils and wildlife habitat, minimize harassment of wildlife, maintain adequate bull escapement, and promote quality hunting. (Chesnimnus 1988 Cooperative Travel Management Area Map)

Clearcutting - Removal of virtually all the trees, large or small, in a timber stand in one cutting operation. Leads to the establishment of an even-aged stand.

Climax Native Vegetation - The plant community that will dominate a site if not disturbed by fire, grazing, logging, or erosion.

Commercial Forest Land - Forest land tentatively suitable for the production of continuous crops of timber and that has not been withdrawn from harvest entry.

Commercial Thinning - Any type of thinning of trees producing merchantable material at least equal to the value of the direct costs of timber harvesting.

Condition and Trend (Land) Transects - An inventory system designed to measure range (vegetation) condition and trend (getting better or worse).

Contract Provisions - Controls, constraints, and/or general direction included in contracts offered by the Forest Service.

Cover - Vegetation used by wildlife for protection from predators and weather or in which to reproduce.

Created Opening - An opening in the forest created as the result of even-aged silviculture through clearcutting, group selection, or shelterwood regeneration timber harvest systems.

Critical Habitat - That habitat designated by the Secretary, USDI, as critical to the continued survival of threatened or endangered species.

Crop Tree - Any tree forming, or selected to form, part of the final crop; generally a tree selected in a young stand for that purpose.

Crossdrain (or waterbar) - A man-made berm and/or ditch constructed to intercept surface water runoff and divert it before the runoff concentrates to excessive erosive volumes and velocities.

Crown Cover - When looking at aerial photographs, crown cover is the percent of the total ground area that is blocked from view by trees or brush needles/leaves/branches.

Crowning - Forming a convex road surface which allows runoff to drain from the running surface to either side of the road prism.

Culmination of Mean Annual Increment (CMAI) - The age at which the annual increment of growth of a timber stand reaches its maximum.

Cultural Resources - Buildings, sites, areas, architecture, memorials, and objects having scientific, prehistoric, historic, or social values.

Cumulative Effect - The impact on the environment which results from the incremental impact of the action when added to other actions. Cumulative impacts can also result from individually minor but collectively significant actions taking place over a period of time.

Current Direction - The combination of activities dictated by laws, regulations, the Forest Service Manual, and existing unit plans.

D

Deferred Forest Land - Productive forest land that has been administratively identified for study as possible addition to the National Wilderness Preservation System or otherwise withdrawn from timber utilization under authority granted in the Code of Federal Regulations (CFR).

Deferred Rotation Grazing System - A type of grazing management where the grazed area is divided into two or more pastures. One or more of the pastures are grazed for only part of the grazing season. The following season the period of use is rotated.

Degraded Watershed - A watershed on which depleted vegetative cover and physical disturbance of the land surface have resulted in conditions such that the soil mantle, slopes, and/or channels are unstable. The environmental damage may result from either natural or man-made causes. Watersheds typically exhibit gullies, rills, slumps and land slides, and scoured or aggregated stream channels.

Designated Swimming Waters - Swimming waters are defined as those in which swimming, wading, dabbling by children, diving, and other forms of primary water contact recreation are specifically encouraged by signs or public notice, or through the development of facilities normally associated with such use on, or immediately adjacent to, the body of water.

Deterioration of Volume - Fire-killed timber will lose commercial log value over time. The decay process includes softening, progressive loss of strength and weight, and changes in the texture and color of wood. Causes of deterioration are fungi, insects, and weathering. Staining by fungi and insect boring result in drops in log grade classification. The rate of deterioration varies by tree species, size, moisture, temperature, and elevation.

Diameter at Breast Height (DBH) - The diameter of a tree 4.5 feet above average ground level, except that in National Forest practice it is measured from the highest ground level. Abbreviated dbh. The additional abbreviations ob and ib are used to designate whether the diameter refers to the measurement outside or inside the bark.

Discount Rate, Real - A discount rate adjusted to exclude the effects of inflation.

Dispersed Campsite - A campsite where if there are facilities or developments provided, they are more for access and protection of the environment than for the comfort or convenience of the people.

Dispersed Recreation - Recreation use outside a developed recreation site, including scenic driving, camping, hunting and backpacking.

Dispersed Recreation/Native Vegetation Allocation - (See Management Allocations)

Dispersed Recreation/Timber Management Allocation - (See Management Allocations)

Distance Zones - Areas of landscapes denoted by specific distances from the observer. Used as a frame of reference in which to discuss landscape characteristics or activities of man. The three distance zones are:

Foreground (fg) extends from the viewpoint out to 1/2 mile.

Middleground (mg) is from 1/2 to 5 miles.

Background (bg) extends beyond 5 miles from the viewpoint.

Diversity - the distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan.

Dragtrail - A place where a log being pulled on the end of a cable has been the only influence in causing bare soil exposure.

Primary Dragtrail - A dragtrail that exists in conjunction with all yarding methods except helicopter, full suspension skyline, and ground-based skidding. It occurs in-line with the main cable that leads uphill to the yarder, and almost always has multiple log dragging events repeatedly occurring on the single dragtrail location.

Secondary Dragtrail - A dragtrail produced by the mostly side yarding that occurs as logs are pulled either (a) to a carriage which is located on the main cable, or (b) to the end of a ground-based skidding vehicle.

Dwarf Mistletoe - A parasitic plant considered a forest pest. Each species of host tree has a corresponding species of dwarf mistletoe which attacks it.

E

Ecoclass - A classification system for identification and mapping of basic vegetative resources and their characteristics.

Ecosystem - The interacting system of a biological community and it's non-living environment.

Edaphic - Related to or caused by particular soil conditions, as of texture or drainage, rather than by physiographic or climatic factors.

Electrofishing - Fish sampling using equipment to put an electric current in the water, which stuns the fish so they can be collected for identification and then released without injury.

Empirical Yield Table - A table showing, for one or more given species on a given site, the progressive development (growth and yield) of a stand at periodic intervals covering the greater part of its useful life. This table is prepared on the basis of actual average stand conditions.

Endangered Species - Any species of animal or plant which is in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of Interior as endangered in accordance with the 1973 Endangered Species Act, as amended.

Endemic - A taxonomic category (e.g., genus, species, variety) whose natural occurrence is confined to a certain region and whose distribution is relatively limited.

Environment - The aggregate of physical, biological, economic, and social factors affecting all organisms in an area.

Environmental Analysis - An analysis of alternative actions and their predictable short- and long-term environmental effects, which include physical, biological, economic, social, and environmental design factors and their interactions.

Environmental Assessment - A concise public document which provides sufficient evidence and analysis for determining whether to prepare an Envionmental Impact Statement or a Finding of No Significant Impact. It aids in compliance with the NEPA when no Environmental Impact Statement is needed.

Environmental Impact Statement (EIS) - A document prepared by a Federal Agency in which anticipated environmental effects of a planned course of action or development are evaluated.

Erosion - Detachment or movement of soil or rock fragments by water, wind, ice, or gravity. Accelerated erosion is much more rapid than normal, natural, or geologic erosion, primarily as a result of the influence of activities of man, animals, or natural catastrophes.

Ethnography - The branch of anthropology that deals descriptively with specific cultures, especially those of aboriginal people or groups.

Evaluation Criteria - Standards to judge and compare management alternatives and to help select a preferred alternatives.

Evapotransporation - The combined loss of water from a given area during a specific period of time by evaporation from the soil surface and by transpiration from plants.

Exclosure - A fenced area that keeps unwanted animals out to prevent resource damage.

F

Fines - The fine sediment component of sediment delivered to and transported through the stream channel. Fine sediments are those particles less than 6.4 mm in diameter, of which at least 20 percent are less than 0.8 mm in diameter.

Floodplain - The lowland and relatively flat areas adjoining inland and coastal waters, including debris cones and flood-prone areas of offshore islands, including, at a minimum, that area subject to a 1 percent or greater chance of flooding in any given year.

Forage Allocation - (See Management Allocations)

Forage Areas - Forest stands that do not qualify as either marginal or satisfactory cover and all natural and human-made openings.

Forage Cover Ratios - The ratio of area available for foraging wildlife to the area which meets wildlife cover needs.

Force Account Activity - An activity that is funded with USDA Forest Service appropriations and accomplished utilizing Forest Service personnel, equipment, and crews.

Forb - Any herbaceous plant species other than those in the Gramineae (grasses), Cyperaceae (sedges), and Juncaceae (rushes) families; fleshy-leaved plants.

Fuelwood - Wood that is round, split, or sawn and/or otherwise generally refuse material cut into short lengths or chipped for burning.

Full Stocking Control - As used in timber management, control of the number of trees for a given area in order to use the sunlight, water and soil nutrients for maximum wood growth.

G

Geographic Information System (GIS) - A modeling system using computer mapping and data tables to generate layers of information or sort desired information about the ecosystem. Maps are generated at requested scale.

Geomorphic - Refers to relief features of the earth surface.

Goal - A broad but concise statement of the desired state of condition that land and resource management are designed to achieve.

Ground Cover - Organic and/or inorganic matter that covers the soil surface, including such things as low growing plants, rock and rock fragments, and debris such as leaves and twigs.

Ground Fuel - That fuel lying on or within six feet of mineral soil surface.

Growth Basal Area - That basal area that would permit trees to grow at a specified number of growth rings per inch.

H

Habitat - The sum total of environmental conditions of a specific place occupied by a wildlife or plant species, or a population of such species.

Hazardous Substances - Materials which by their nature are inherently dangerous to handle or dispose of, such as radioactive materials, some chemicals, and some biological wastes.

Hazard Tree - A tree in a use area possessing weakness or defects with a probability of any part falling and causing injury or property loss.

Hiding Cover - Vegetation capable of hiding 90 percent of an elk from view by a human at a distance equal to or less than 61 meters (200 feet).

Horizontal Drains - Drains installed in cut slopes and beneath fills to remove subsurface water and guard against slides in problem areas. Typically, they consist of placing perforated metal or plastic pipes in drill holes that have been bored horizontally into the aquifer or water-bearing formation.

I

Implementation Plan - Detailed action document that translates the selected land management alternative into on-the-ground instructions.

In-Service - As used pertaining to activities, actions, or personnel within the USDA Forest Service.

Indicator Species - A plant or animal species so highly adapted to a particular kind of environment that its mere presence is sufficient indication that specific conditions are also present.

Individual Tree Selection - The selection of trees for harvest based on the individual tree characteristics, rather than characteristics of trees as a group.

Input-output Analysis - A systematic technique for quantitatively analyzing the interdependence of producing and consuming units in an economy. It studies the interrelations among producers as buyers of each other's outputs, as users of scarce resources and as sellers to final consumers. The technique has been useful for the study of the way in which the component parts of an economy fit together and influence each other, for short-run forecasting, and for policy guidance.

Interception - The process by which precipitation is caught and held by foliage, twigs, and branches of trees, shrugs and other vegetation.

Interdisciplinary Team - A group of individuals with different technical training assembled to solve a problem or perform a task. The forming of the team, the data collection and analysis, team discussions, interactive evaluation, and joint resolution of the problem is the Interdisciplinary Process.

Interpretive Site - A site having facilities such as signs or exhibits, that inform the user and provide some education about the surroundings.

Issue - A point, matter or question to be solved.

K

K-V (Knutson-Vandenburg Act) Funds - An Act of Congress which, among other things, authorizes the Forest Service to use funds collected from timber sales for tree planting, timber stand improvement and other forest uses.

L

Land Allocation - (See Management Allocations)

Landing - A site where logs, harvested during a timber sale, are stored prior to removal from the Forest.

Land Management Planning - The process of organizing the development and use of lands and their resources in a manner that will best meet the needs of people over time, while maintaining flexibility for a combination of resources for the future.

Large Woody Debris - (LWD) Logs or pieces of woody material large enough to become lodged and imbedded in a stream and create pools of value as fish habitat.

M

Maintenance Levels - (See Road Maintenance Plan) (From the Hells Canyon NRA Comprehensive Management Plan)

Management Allocations - The following is a summary of objectives and direction for the NRA Allocations. The reader is directed to the Final Environmental Imapact Statement and Comprehensive Management Plan for the Hells Canyon NRA for a full Discription of the direction.

Objective and direction common to all allocations on the NRA:

- Provide a wide range of recreation opportunities consistant with other objectives specific to each allocation.
- Provide an adequate, well maintained, trail system to serve NRA users.
- Provide adequate interpretive facilities explaining unique features of the NRA.
- Meet or exceed established visual quality objectives with all resource and recreation management activities.
- Maintain or enhance the present level of water quality and soil productivity.
- Maintain and protect fish habitat through careful resource management and recreation development.
- Allow fire to resume a more natural role in shaping NRA flora and fauna and to help accomplish NRA vegetative objectives.
- Emphasize stand condition, scenery, wildlife habitat, and recreation needs over optimum fiber productions.

Objectives and direction specific to Allocations.

Dispersed Recreation/Native Vegetation -

- Do not conduct timber management activities or the gathering of firewood in areas designated DR/NV except that dead and down wood for recreational campfires, administrative and permitted uses may be used.
- Insects, disease, and noxious weeds prevention and control by appropriate measures will be undertaken when necessary to protect timber and other vegetation on private or public lands.
- Emphasize biological measures when it is necessary to control insects or noxious weeds to meet NRA objectives.
- Areas in this allocation will be closed to motor vehicle use except for designated forest transportation roads and oversnow vehicle use on snow.

Dispersed Recreation/Timber Management Allocation

- Manage timber on these areas. Coordinate all timber management activities to assure that ample opportunities for dispersed recreation are available. Give priority to maintaining a variety of tree species and diversity of sizes and age classes.

- Maximum opening size is two acres if created for timber management purposes. Larger openings may be created for other resource objectives. However, such proposals are to be considered discreetly on a case-by-case basis.
- Retain at least 10 percent of commercial forest land as old growth. Hiding cover as defined in "Wildlife Habitats in Managed Forest of the Blue Mountains" will be maintained at no less than 60 percent of the optimum situation as it relates to size and spacing of forage and cover blocks.
- Manage riparian zones to provide continuity between old growth stands.
- Limit timber harvest roads. Emphasize log yarding systems that minimize the need to construct roads. Close timber harvest roads unless needed to meet recreation objectives.

Forage Allocation

- Manage timber stands included in these areas as old growth. Timber management activities would take place only when determined desirable for wildlife habitat improvement or for recreation or scenic values.

Scenic River Corridor Allocation

- Maintain, or enhance, the values for which the NRA was established including the protection of cultural resources, fish and wildlife, unique biological communities, scientific values and scenery.
- Provide for a wide range of recreation uses compatible with the provisions of the Wild and Scenic Rivers Act and Hells Canyon NRA Act.

Management Area - The land area on which a certain management strategy is applied.

Management Direction - A statement that includes: multiple use and other goals and objectives, the associated management strategies, and standards and guidelines for attaining them.

Management Strategy - Management practices and intensity selected and scheduled for application on a management area to attain multiple use and other goals and objectives.

Management Prescription - See Management Strategy.

Marginal Cover - A stand of conifer trees 10 or more feet tall, with a canopy closure equal to or more than 40 percent.

Mass Movement - See soil mass movement.

Maximum Disturbance Threshold - "Disturbance-at-one-time" is a visual concept which addresses the cumulative effects of management activities (i.e., timber harvesting) occurring over a given time period (20 years) in a specific landscape (viewshed). The acceptable amount of disturbance at one time for each VQO for each viewshed is called "Maximum Disturbance Threshold" and is 14 percent for Partial Retention Foreground, 20 percent for Partial Retention Middleground, and 30 percent for Modification Middleground.

MBF - Thousand board feet of timber.

MMBF - Million board feet of timber.

Mitigation - To offset or lessen real or potential impacts or effects through the application of additional controls or actions. Counter measures employed to reduce or eliminate undesirable or unwanted results.

Moist Potential Vegetation - Vegetation that will dominate an undisturbed moist site. (e.g., spruce).

Monitoring - The evaluation, on a sample basis, of management practices to determine how well objectives are being met, as well as the effects of those management practices on the land and environment.

Mulch - A natural or artificial layer of plant residue or other materials such as sand or paper, on a soil surface.

Multiple Use - The management of all the various renewable surface resources of the National Forest System in such a way that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some lands will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output. (16 USC 531(a))

N

National Environmental Policy Act of 1969 (NEPA) - The purposes of the Act are: to declare a national policy which will encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the nation; and to establish a Council on Environmental Quality.

National Wild and Scenic River System - See Wild, Scenic, and Recreational Rivers.

Native Vegetation - Flora which has not been introduced by humans, but which may include vegetation which has naturalized. Cheatgrass from the EurAsian steppe is a naturalized plant.

NEPA Process - A process, mandated by NEPA, which concentrates decisionmaking around issues, concerns, alternatives, and the effects of alternatives on the environment.

NFMA - The National Forest Management Act of 1976.

No Action Alternative - The No Action Alternative is required by regulations implementing the National Environmental Policy Act (NEPA) (40 CFR 1502.14). The No Action Alternative provides a baseline for estimating the effects of other alternatives. Where a project activity is being evaluated, the no action alternative is defined as one where no action or activity would take place.

Nonpoint Source Pollution - Nonpoint sources are diffuse or unconfined sources of pollution where wastes can either enter into - or be conveyed by the movement of water to - public waters (Oregon Water Quality Standards, 340-41.007(17). Silvicultural sources, such as erosion from a harvest unit or surface erosion from a road are considered nonpoint sources.

O

Obligate Parasite - Requires a living host.

Old Growth Stand - A stand that is past full maturity and showing decadence; the last stage in forest succession; the USDA Forest Service's working definition for old-growth stands in the Blue Mountains is 37 live trees or more per hectare (15/acre) over 53 centimeter (21-in) dbh, 1.2 or more snags per hectare (0.5 snag/acre) over 53 centimeter (21-in) dbh, two or more canopy levels, heart rot, or other signs of stand decadence present and obvious, overstory canopy closure of 10-40 percent, usually with a definite shrub-sapling layer with a canopy closure of over 40 percent, with understory and overstory canopy combined exceeding 70 percent, and logs obvious on the ground.

Open Road - Any road that has more than five vehicle trips per month.

Open "Countable" Roads - A term used in the Elk Habitat Effectiveness Index (HEI) model. It refers to the miles of open roads. The open roads within the interior of the project area are counted at 100 percent and the roads bordering the project at 50 percent.

Optional Volume - Timber volume which is of marginal value but could be merchantable based on the efficiency of the logger and the mill which is processing it. Timber designated by the Forest Service prior to sale advertisement which may become included timber and paid for at specified rates upon written agreement with purchaser.

Optimum Fiber Production - The best or most favorable wood fiber production situation.

Orthophoto - An aerial photo which has been corrected to remove distortion.

Outsloping - Shaping a road to cause drainage to flow toward the outside shoulder (generally the fill slope), as opposed to insloping which encourages drainage to flow to the inside shoulder (generally the cut slope). Emphasis is on maintaining sheet flow and avoiding water concentration.

Overland Flow - Flow of water over the surface of the soil outside a defined stream channel.

P

Paleontology - The branch of geology that deals with prehistoric forms of life through the study of plant and animal (except human) fossils.

Partial Retention/Visual Quality Objective - See Visual Quality Objective

Peakflow - The greatest volume of streamflow within a specified time period.

Perennial Streams - A streamcourse that has surface flow in most places during a year when snowpack has been near average.

Permittee - Individual or entity that has received a grazing or Special Use Permit from the Forest Service.

Petroglyph - An aboriginal picture chiseled onto rock.

Photosynthate - The product of photosynthesis.

Pictograph - An aboriginal rock drawing executed in pigment.

Plant Association - Plants which typically grow together, given certain site conditions.

Point Source - Originating from a discrete identifiable source or conveyance.

Policy - A guiding principle upon which is based a specific decision or set of decisions.

Precommercial Thinning - Any type of thinning that takes place in a stand of trees before the size or condition of the material cut or killed makes it of sufficient value to meet the costs of the activity.

Preferred Alternative - The agency's preferred alternative(s), one or more, that is identified in the draft statement (40 CFR 1502.14).

Prescribed Fire - Fire used as a management tool under a specified condition for burning a defined area.

Prescription - Management practices selected and scheduled for application on a specific area to attain goals and objectives.

Present Net Value (PNV) - Discounted benefits less discounted costs.

Productivity/Sensitivity Analysis - An analysis used to determine the capability of a given unit of land to support specific activities by identifying and comparing productivity and sensitivity.

Programmed Harvest - Timber scheduled for harvest for a specific year. Normally established at a rate to provide a sustained even flow.

Public Issue - A subject or question of widespread public interest relating to management of the National Forest System.

Purchaser - The entity which is awarded a USDA Forest Service contract after bidding, usually with competition. As used in timber, the entity which has purchased timber as identified in a timber sale contract.

R

Range Condition - Good - Vegetation condition classification is rating vegetation according to its degree of deterioration or change from the potential vegetation which the site is capable of producing. If the present vegetation is similar to the potential, range condition is good; if present vegetation is moderately different from the potential, condition is fair; if present vegetation is quite different from the potential but still contains some decreaser plants and many palatable increasers, it is rated poor condition; if all decreasers are absent and only a few palatable increasers are present, condition is rated very poor.

Range Use - Utilization of vegetative resources in a wildland environment by domestic livestock.

Raptor - Any predatory bird, such as a falcon, hawk, eagle, or owl, that has feet with sharp talons or claws adapted for seizing prey and a hooked beak for tearing flesh.

RARE II - An acronym for a second generation "Roadless Area Review and Evaluation" by the Forest Service. Its purpose was to determine which of the inventoried areas should be recommended to Congress for inclusion in the National Wilderness Preservation System, which areas should be managed for non-wilderness uses, and which areas require further planning.

Receipts (Revenues) - Those priced benefits for which money will actually be paid to the Forest Service. They would include recreation fees, timber harvest payments, mineral leases, and special use fees.

Reconstruction - Activities performed on an existing road or other facility to restore it to a specified standard.

Recreation Opportunity Spectrum (ROS) - An array of recreational activities, settings, and experiences used as a basic framework in planning and managing the recreation resource. This spectrum is divided into the following classes: primitive, semiprimitive nonmotorized, semiprimitive motorized, roaded natural, rural, and urban.

Primitive - Area is characterized by essentially unmodified natural environment of a size or location that provides the opportunity for isolation from sights and sounds of people. The user has the opportunity to be a part of the natural environment, often with a high degree of challenge and risk in which to use a maximum degree of outdoor skills. The area is managed to be as free as possible from evidence of people-induced restrictions and controls. Only essential facilities for resource protection are used. Motorized use within the area is normally not permitted.

Semiprimitive Nonmotorized - Area is characterized by predominantly unmodified natural environment of a size or location that provides a good-to-moderate opportunity for isolation from sights and sounds of people. The user has the opportunity for a high degree of interaction with the natural environment. The area is managed in such a way that minimum on-site controls and restrictions may be present. Facilities are primarily provided for the protection of resource values and safety of users. Motorized use is not normally permitted.

Semiprimitive Motorized - Area is characterized by predominantly unmodified natural environment of a size or location that provides a good-to-moderate opportunity for isolation from sights and sounds of people except for facilities essential for the use of motorized equipment. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Facilities are primarily provided for the protection of resource values and safety of users. Motorized use is permitted. Limited primitive road construction to enhance recreation opportunity is permissible.

Roaded Natural - Area is characterized by predominantly natural appearing environments with moderate evidences of the sights and sounds of people. Such a way that minimum on-site controls and restrictions may be present, but are subtle. Facilities are primarily provided for the protection of resource values and safety of users. Motorized use is permitted. Limited primitive road construction to enhance recreation opportunity is permissible.

Rural - Area is characterized by substantially modified natural environment. Resource modification and utilization practices are to enhance specific recreation activities and to maintain vegetative cover and soil. Sights and sounds of humans are readily evident, and the interaction between users is often moderate to high. A considerable number of facilities are designed for use by a large number of people. Facilities are often provided for special activities. Moderate densities are provided far away from developed sites. Facilities for intensified motorized use and parking are available.

Urban - Area is characterized by a substantially urbanized environment, although the background may have natural appearing elements. Renewable resource modification and utilization practices are to enhance specific recreation activities. Vegetative cover is often exotic and manicured. Sights and sounds of humans, on-site, are predominant. Large numbers of users can be expected, both on site and in nearby areas. Facilities for highly intensified motor use and parking are available with forms of mass transit often available to carry people throughout the site.

Recreation Visitor Day (RVD) - The use of an area by one or more people for 12 person-hours, either continuously or spread over several visits. One person visiting a recreation site for one day (12 hours) is one recreation visitor day (RVD).

Reforestation - Reforestation includes measures to obtain natural regeneration, as well as tree planting and seeding. The work is done on National Forests to produce timber and other forest products, protect watersheds, prevent erosion, and improve other social and economic values of the forests, such as wildlife, recreation, and natural beauty.

Regeneration - The renewal of a tree crop, whether by natural or artificial means. Also the young tree crop itself.

Rehabilitation - The act of restoring a portion of land to its former state or capacity. This can be done by reshaping the land and/or planting grass, forbs, shrubs, or trees. Landscape rehabilitation is a short-term management alternative used to restore landscapes containing undesirable visual or resource damage to a desired quality. Rehabilitation may be achieved through alteration, concealment, or removal or obtrusive elements.

Resource Allocation - Designating certain parcels of land for the production of certain resources. The resources derived may be commodities, amenities, or combinations of each. For the purpose of this document, resource allocation is synonymous with land management allocation.

Revegetation - The replacement of vegetative cover which has been harvested or lost due to natural occurrences such as wildfire. Accomplished either through planting of nursery stock or seeding, or through natural processes.

Rill Erosion - Detachment of soil by land-surface flow that is concentrated into hillside microchannels - this flow started out as sheet erosion and then became concentrated after travelling ten feet or so. (See sheet erosion also.)

Riparian Brush/Shrubs - Brush/shrubs that require soils that are very wet (have free or unbound water) for much of the year.

Riparian Area - Composed of the aquatic and riparian ecosystems. The aquatic ecosystem is the area within the stream channel. The riparian ecosystem is the ground area identified by distinctive vegetation communities and soil characteristics that require free or unbound water.

Riparian Management Zone (RMZ) - Composed of the riparian area and an adjacent dryland area. The dryland area provides close-by dry habitat needed by some wildlife that utilize the wetter areas; it also acts to lessen microclimate warming in the moister areas caused by opening adjacent upslope tree stands. A riparian management zone exists, at least, adjacent to all Class I, II, and III streamcourses (generally perennial streams).

Road - A general term denoting a way for purposes of travel by vehicles greater than 40 inches in width. (FSM 7721.15c)

Road Density - Average of miles of roads kept open for public use for each square mile.

Road Maintenance Plan - A documented schedule and program for upkeep of roads to provide a level of service for the user. There are five levels of maintenance; Level I being the lowest level of upkeep and Level V being the highest level of upkeep. Listed below are the three levels used in the project area.

Maintenance Level 1 - This level is basic custodial care as required to protect the road investment and to see that damage to adjacent land and resources is held to a minimum. Level 1 maintenance often requires an annual inspection to determine what work, if any, is needed to keep drainage functional and the road stable. This level is the normal prescription for roads that are not opened for traffic. Level 1 is to maintain drainage facilities and runoff patterns.

Physical closure devices and appropriate signing are in place and functional in accordance with FSH 7770.

Maintenance Level 2 - This level is used on roads where management requires that the road be open for limited passage of traffic. Traffic is normally minor, usually consisting of one or a combination of the following: Administrative use, permitted use, or specialized traffic.

All route markers, regulatory, and warning signs in place and usable.

Maintenance Level 3 - This level is used on roads which are opened for public traffic and generally applies when use does not exceed 15 AOT. AOT should be used as a guide in determining the Maintenance Level and not as a sole criteria. A road may receive only one or two vehicles a day for most of the year; however, during a brief period; i.e., hunting season, the road may receive 20 or 30 vehicles a day. Total traffic types and planned use are important criteria for selecting Maintenance Level. The road is maintained for safe and moderately convenient travel suitable for passenger cars.

Signing. Route markers, warning, directional, information, regulatory signs and traffic control devices are in place, neat in appearance, and functional.

Rocking - The application of aggregate on a road to provide a more stable, erosion resistant facility.

ROS - See Recreation Opportunity Spectrum.

Rotation - (as used in reference to timber) - The period of years between the initial establishment of a timber stand and the time when it is considered ready for cutting and regeneration.

RPA - Forest and Rangelands Renewable Resources Planning Act of 1974.

Rustic (campgrounds, recreation sites, character) - A development of simple, unpretentious character. Facilities are minimum including pit (vault) toilets, tables and fire rings. Defined as a Level 3 facility in the Forest Service Manual.

S

Salvage Cutting - Removal of recently dead trees.

Sanitation Cutting - The removal of dead, diseased, infested, damaged, or susceptible trees essentially to prevent the spread of pests or pathogens and so promote forest hygiene.

Satisfactory Cover - A stand of coniferous trees 40 or more feet tall, with an average canopy closure equal to or more than 70 percent.

Scabland - Land having very thin soil, often with much rock or erosion pavement visible.

Scenic River Corridor Allocation - See Management Allocations.

Scoping - The procedures by which the Forest Service determines the extent of analysis necessary for a proposed action, i.e., the range of actions, alternatives, and impacts to be addressed, identification of significant issues related to a proposed action, and establishing the depth of environmental analysis, data, and task assignments needed.

Sediment - Considering stream systems, sediment is particles derived from rocks which are transported by, suspended in, or deposited by streamflow or mass movement directly into the streamcourse. Ordinarily this excludes ice or floating organic material.

Sediment Delivery - Eroded soil that has reached a streamcourse.

Sediment Yield - The total sediment volume being moved in a stream past any given point. It includes the movement of bedload plus the movement of all finer sized rock-derived materials, and is expressed in terms of mass or volume per unit of time.

Selective Harvest - An unevenaged management system resembling individual tree selection or removal of trees in small groups, in order to realize timber yield and establish a new stand of irregular constitution.

Sensitivity Levels - Sensitivity classification is based on the level of social importance of travel routes, use areas, and water bodies, and the lands seen from them. There are three levels of importance, generally:

Level 1 (High) - Areas of high public concern for scenery.

Level 2 (Average) - Area of average public concern for scenery.

Level 3 (Low) - Areas of low public concern for scenery.

Sensitive Species - Those species which (1) have appeared in the Federal Register as proposals for classification and are under consideration for official listings as endangered or threatened species, (2) are on an official State list, or (3) are recognized by the Regional Forester as needing special management in order to prevent the need for their placement on Federal or State lists.

Seral Brushfields - Brushfields which grow to temporarily dominate a site following fire or logging.

Sheet Erosion - Detachment of soil by raindrop impact and its subsequent removal by land-surface water flow. This process occurs more-or-less uniformly over the entire soil surface. (See rill erosion also.)

Significant (NEPA) - Requires consideration of both context and intensity. Context means that the significance of an action must be analyzed in several contexts such as society as a whole, and the affected region, interests, and locality. Intensity refers to the severity of impacts (40 CFR 1508.27).

Significant Disturbance - Human-caused disturbance of surface resources, including soil, water, and vegetation, which has the potential to cause degradation of water quality to the magnitude which would require corrective action. It is disturbance most commonly associated with the use of mechanized, ground operated equipment.

Silviculture - The theory and practice of controlling the establishment, composition, competition, and growth of forests.

Silvicultural System - A management process whereby forests are tended, harvested, and replaced, resulting in a forest of distinctive form. Systems are classified according to the method of carrying out the fellings that remove the mature crop and provide for regeneration, and according to the type of forest thereby produced.

Site Preparation - The activity of preparing a site for revegetation. It can be accomplished by either mechanical, chemical, or biological means, or controlled fire.

Site-Specific - Pertains to a discernible, definable area or point on the ground where a project or activity will (or is proposed to) occur.

Skidtrail - A place where ground based yarding has caused bare soil exposure due to the combined effect of both equipment and log skidding.

Snag - In the Blue Mountains, a snag is defined as any dead or partly dead tree at least 4 inches dbh and at least six feet tall.

Hard Snag- A snag composed primarily of sound wood, particularly sound sapwood; generally merchantable.

Soft Snag - A snag composed primarily of wood in advanced stages of decay and deterioration, generally not merchantable.

Soil Displacement - The movement of the forest floor (litter, duff, and humus layers) and surface soil from one place to another by mechanical forces such as a blade used in piling or windrowing. Mixing of surface soil layers by disking, chopping, or bedding operation, are not considered soil displacement.

Soil Friability - The ease with which soil can be crumbled in the hand.

Soil Mass Movements - The process of soil being moved downslope primarily by gravitational forces.

Soil Nutrient - Elements or compounds, essential as raw material for growth and development, such as nitrogen, phosphorous, potassium, oxygen, etc.

Soil Productivity - The capacity of the soil in its normal environment to produce a specified plant(s) or sequence of plants under natural conditions or under a specified system of management.

Soil Resiliency - The ability of the soil to regain productive potential following natural or management induced disturbance.

Special Precaution Zone - An area where activity of a specific type is limited by rules; this is contrasted to a buffer area in which a specific type of activity is completely prohibited.

Special Use Permit - A permit issued by a Forest Line Officer to an applicant defining the limitations and constraints for using National Forest land.

Specified Road - A forest development transportation system road identified (specified) in a timber sale contract.

Standards - A principle requiring a specific level of attainment, a rule to measure against.

Stocking Level - In a forest, a subjective indication of the number of existing trees as compared to the desirable number for the best results - e.g., maximum productivity of wood.

Stream Class - The present and foreseeable uses made of the water and the potential effects of on-site changes on downstream uses, are the criteria for defining four stream classes. The importance of use will be relative to the general area. Size is not necessarily a criterion for classification. One stream may be sectionalized into several classes.

Class I	Perennial or intermittent streams or segments thereof that have one or more of the following characteristics. Direct source of water for domestic use (FSM 2543 - cities, recreation sites, etc.) Used by large numbers of fish for spawning, rearing, or migration, Flow enough water to be a major contributor to the quantity of water in a Class I stream.
Class II	Perennial or intermittent streams or segments thereof that have one or both of the following characteristics: Used by moderate though significant numbers of fish for spawning, rearing, or migration. Flow enough water to be a moderate or not clearly identifiable contributor to the quantity of water in a Class I stream, or be a major contributor to a Class II stream.
Class III	All other perennial streams or segments thereof not meeting higher class criteria.
Class IV	All other intermittent streams or segments thereof not meeting higher class criteria.

Streamcourse - A natural configuration in the land surface which transports water in a perennial or intermittent circumstance. It is classified as either Class I, II, III, or IV.

Streamside Management Unit (SMU) - An area of specific width adjacent to streamcourses that always includes a special precaution zone, and at times also a buffer zone.

Stumpage - Standing timber usually expressed as $/MMBF.

Suitability - The appropriateness of applying certain resource management practices to a particular unit of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone. A unit of land may be suitable for a variety of individual or combined management practices.

Suitable Forest Land - Forest land that is producing or is capable of producing crops of industrial wood, has not been withdrawn from timber harvest activities by legal action, and there is reasonable assurance that it is possible to restock adequately within five years of final harvest.

Summer Range - A portion of the total range on which big-game animals normally find food and cover during summer months.

Sunk Cost - Any expenditure which will have been made prior to implementation of the preferred alternative.

T

Thermal Cover - Cover used by animal to ameliorate effects of weather; for elk, a stand of coniferous trees 12 meters (40 feet) or more tall with an average crown closure of 70 percent or more; for deer, cover may include sapings, shrubs, or trees at least 1.5 meters (5 feet) tall with 75 percent crown closure.

Thinning - A felling made in an immature tree crop or stand in order primarily to accelerate diameter increment but also, by suitable selection, to improve the average form of the trees that remain, without--at least according to classical concepts--permanently breaking the canopy.

Threatened Species - A species which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and which has been designated in the Federal Register by the Secretary of Interior as a threatened species. (Endangered Species Act of 1973).

Timber Production - The purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use. For purposes of this definition, the term "timber production" does not include production of fuelwood.

Timber Stand Improvement (TSI) - Practices such as thinning or planting which are intended to assist in meeting management objectives.

Trail - A general term denoting a way for purposes of travel by foot, stock, or motorized vehicle.

Trailhead - A site that provides access to a trail or to several trails. facilities may include, but not be limited to, parking areas, stockramps, hitchracks, bulletin boards, and toilets.

Transect - A measured course on the land or along a stream course established to systematically record information pertaining to the environment encountered.

Total Resource Inventory System (TRI) - A natural resource data base used on National Forests in the Pacific Northwest (Washington and Oregon) to provide storage and retrieval for in-place resource data. TRI system is a multimedia information system using maps, photographs, paper forms, microfilm and computer storage to handle large volumes of data.

Tri Compartment - A photo map area for indexing and storing data locations. The scale is 4" = 1 mile, and includes approximately 6,500 to 8,000 acres, with boundaries of photo-identifiable topographic features. Each compartment has a unique name and number used for storage.

Turbidity - An optical property of water that is affected by the suspension of material such as suspended sediment -- the degree of muddiness or cloudiness of water.

U

Unevenaged Management - The course of action involved in maintaining a forest or stand composed of intermingled trees that differ markedly in age.

Unregulated Forest - Forest land that is not organized for timber production under sustain yield principles. Timber harvest may occur but is not a part of the potential yield. Timber management activities would normally be for reasons other than for wood fiber production, such as wildlife habitat improvement or recreation purposes.

Unsuitable Forest Land - Forest land withdrawn from timber utilization by statute or administrative regulation, or identified as not appropriate for timber production in the Forest planning process.

V

VAC (Visual Absorption Capability) - A measure of the relative ability of the land to absorb visual change.

Variety Class - A particular level of visual variety or diversity of landscape character. Variety class is identified as: "A" highly scenic, "B" average scenery, and "C" dull or monotonous scenery, as compared to the landscape character type as a frame of reference. (See Character Type)

Vehicle (motorized) Camping - Camping where access is primarily by vehicle as opposed to camping where access is primarily by foot or horseback.

Viewshed - Sub-units of the landscape where the visitor's view is contained by topography, similar to a watershed.

Visual Condition - An analysis of how natural-appearing viewsheds are today. It is a measure of the amount of change from a pristine state and the amount of visual contrast present. There are four existing visual condition classes:

Natural Appearing - A viewshed in which no more than 5 percent of the area actually seen appears to be visually altered.

Slightly Altered - A viewshed in which no more than 10 percent of the area actually seen appears to be visually altered.

Moderately Altered - A viewshed in which no more than 20 percent of the area actually seen appears to be visually altered.

Heavily Altered - A viewshed in which more than 20 percent of the area actually seen appears to be visually altered.

Visual Quality Objective (VQO) - Combines inherent scenic quality and public interest to establish measurable standards for visual resource management based on the acceptable degree of alteration of the characteristic landscape. The VQO classes and their definitions are:

Preservation - Provides for ecological changes only.

Retention - Activities are not evident to the casual forest visitor.

Partial Retention - Activities may be evident, but must remain subordinate to the characteristic landscape.

Modification - Activities may dominate, but must utilize naturally-established form, color, and texture. These areas should appear natural when viewed in foreground or middleground situations.

Maximum Modification - Activities may dominate, but should appear as a natural occurrence in background situations.

Visual Resource - The composite of landforms, water features, vegetative patterns, and cultural features which create the visual environment.

Volitalization - Loss of soil nutrients through combustion of organic matter.

VQO (Visual Quality Objectives) - Combines inherent scenic quality and public interest to establish a permissible (or impermissible) degree of alteration for any given area.

W

Wallowa-Snake Province - This geographic province includes the Wallowa Mountain and Seven Devils uplifts, the dissected basalt plateau and the canyonlands of the Snake, Grande Ronde, and Imnaha Rivers.

Waterbar - (See crossdrain.)

Watershed Specialist - Fish biologists, geologists, hydrologists, and soil scientists working for the Forest Service in the field of natural sciences or biology.

Water Source - An undeveloped or developed spring that has a recreational value.

Wetlands - Those areas that are inundated by surface or groundwater with a frequency sufficient to support, and under normal circumstances does or would support, a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, springs, seeps, wet meadows, river overflows, mud flats, and natural ponds.

Wild, Scenic, and Recreational Rivers - Rivers or river segments which have been designated as part of the National Wild and Scenic Rivers System (Public Law 90-543, 1968). Brief summaries of criteria for classification within this system are as follows:

Wild Rivers - Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.

Scenic Rivers - Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

Recreational Rivers - Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

Wilderness - All lands included in the National Wilderness Preservation System by Public Law; generally defined as undeveloped Federal land retaining its primeval character and influence without permanent improvements or human habitation.

Wilderness Potential - Areas generally 5,000 acres or larger in which the natural features of the area's ecosystems are intact and uninterrupted by the sights, sounds, smells of human habitation, or permanent improvements, and offer the opportunities for solitude, self reliance, and primitive experiences.

Wildlife - Any non-domesticated terrestrial vertebrate animal.

Winter Range - A range, usually at lower elevation, used by migratory deer and elk during the winter months; usually smaller and better-defined than summer ranges.

X

Xeric - Of, or pertaining to, or adapted to a dry habitat.

Y

Yarding - A method of bringing logs in to a roadside area or landing, for truck transport. Methods may include forms of skyline cable logging systems, balloon, helicopter, etc.

ABBREVIATIONS AND ACRONYMS

AIRFA	American Indian Religious Freedom Act of 1978
Alt.	Alternative
ARPA	Archaeological Resource Protection Act of 1979
ASQ	Allowable Sale Quantity*
AUM	Animal Unit Month*
BLM USDI	Bureau of Land Management
BMP	Best Management Practice*
CEQ	Council on Environmental Quality
CFL	Commercial Forest Land*
CFR	Code of Federal Regulations
CFS	Cubic Feet Per Second
DBH	Diameter Breast Height*
DEIS	Draft Environmental Impact Statement
DEQ	Oregon Department of Environmental Quality
DOE	Department of Ecology (Washington)
DR/NV	Dispersed Recreation/Native Vegetation*
DR/TM	Dispersed Recreation/Timber Management*
EA	Environmental Assessment*
EIS	Environmental Impact Statement*
EO	Executive Order
EPA	Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FS	Forest Service
FSR	Forest Service Representative
FY	Fiscal Year (Oct. 1 to Sept. 30, unless otherwise noted)
GIS	Geographic Information System*
HEI	Habitat Evaluation Index
HSI	Habitat Suitability Index
IDT	Interdisciplinary Team
K-V	Knutson-Vandenberg Act of 1924*
LMP	Land Management Planning
LWD	Large Woody Debris*
MBF	Thousand Board Feet
MM	Maximum modification, in visual context
$MM	Million Dollars
MMBF	Million Board Feet
MOA	Memorandum of Agreement
MSLE	Modified Universal Soil Loss Equation
NEPA	National Environmental Policy Act

NF	National Forest
NFMA	National Forest Management Act
NFS	National Forest System
NHPA	National Historic Preservation Act of 1966; as amended (80 Stat 915)
NPS	National Park Service
NRA	National Recreation Area
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
ORV	Off Road Vehicle
P.L.	Public Law (also PL)
PNV	Present Net Value*
R-6	Region 6 (Pacific Northwest Region) of the USDA Forest Service
RMZ	Riparian Management Zone
RARE II	Roadless Area Review and Evaluation II*
R.D.	Ranger District (also RD)
ROS	Recreation Opportunity Spectrum*
RPA	Forest and Rangeland Renewable Resource Planning Act of 1974
RVD	Recreation Visitor Day*
SHPO	State Historic Preservation Officer
SIPS	Stratified Inventory Probability System
SMU	Streamside Management Units*
SRI	Soil Resource Inventory
STORET	A storage and retrieval computer system administered by the Environmental Protection Agency.
T&E	Threatened and Endangered Species*
TRI	Total Resource Inventory
TSC	Timber Sale Contract
TSPIRS	Timber Sale Program Information Reporting System
U.S.C.	United States Code (also USC)
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VQO	Visual Quality Objectives*
WRENNS	Water Resource Evaluation of Non-Point Silvicultural Sources (A Procedural Handbook)
YUM	Yarding of Unmerchantable Materials

* Term defined in Glossary

APPENDICES

APPENDIX A

RATE OF DETERIORATION

RATE OF DETERIORATION OF FIRE-KILLED TIMBER

TEPEE BUTTE FIRE RECOVERY PROJECT

By

Steven L. Fletcher, Silviculturist

INTRODUCTION

The Tepee Butte Fire damaged an estimated 230-310 million board feet of timber on National Forest system lands in Wallowa County, Oregon. Deterioration of sawtimber values is a certainty with the passage of time. The questions are, how long will it take for an unacceptable amount of deterioration to occur, and what factors contribute to deterioration?

Basically, losses will result from several biotic and abiotic factors combining in a complex interrelationship providing a broad array of deterioration processes with various time frames.

It is important to document assumptions used to determine rates of deterioration and to display this information for the Environmental Impact Statement (EIS) reader and the deciding Forest Officer. This information will be used in conducting economic analyses.

This paper discusses sawtimber volume and value reductions and is limited to the biological losses which occur following tree mortality. Information in this paper is based on published reports and local experience. It is not in itself a study, but a consolidation of information found in the literature about the deterioration of fire-killed and other dead timber in the western United States and Canada.

Principal tree species involved in the fire area (in order of declining abundance) are: Douglas-fir, grand fir, ponderosa pine, western larch, Engelmann spruce, lodgepole pine, and subalpine fir, with Douglas-fir and grand fir comprising about 72% of the volume. Deterioration rates for individual tree species will be discussed, as well as volume and value deduction methods.

Deterioration is defined as changes of form and color that affect the merchantable value of the main bole wood. Two types of deterioration are recognized. These are: changes affecting the original character of wood but not making it unsuitable for potential use as low grade lumber, and changes that make wood unsuitable or technically undesirable for most uses, even as low grade lumber (Kimmey 1955).

FACTORS AFFECTING DETERIORATION RATE

Fire-killed trees that are left standing generally follow a natural progression of deterioration. The time it takes is determined by a number of variables, such as species, diameter, moisture, temperature, aspect, and elevation.

Tree Species

Tree species vary in their bark thickness, wood fiber strength, moisture content, percent of sapwood and the insects and fungi that will inhabit them. The following is a list of species found within the project area. They are listed in decreasing order of deterioration resistance.

Western larch
Douglas-fir
Ponderosa pine
Engelmann spruce
Lodgepole pine
Grand fir and Subalpine fir

Western larch --- In Western larch, the volume loss the first year is primarily in the small diameter trees and small top logs of larger trees due to cracks and checking from the drying effects of hot summer weather. Minimal sap rot can be expected in the first several years.

Douglas-fir --- In Douglas-fir, volume loss the first year is primarily in the small diameter trees and small top logs of larger trees due to cracks and checking from the drying effects of hot summer weather. Volume loss at the end of the second year is rather dramatic, especially in the smaller diameter class timber which has higher proportions of sapwood. This rate slows considerably after the second year because the larger trees are the only ones remaining yet to be affected. Value loss is seen as somewhat constant with the Grade 1 sawlogs retaining a higher percentage than the Grade 2 and Grade 3 sawlogs.

Ponderosa pine and lodgepole pine --- In ponderosa and lodgepole pine, loss of value because of blue stain will start to develop the same year as beetle attack. Insect attacks in May and June are thus the prime months for blue stain infection. 1/

Value loss is significant at the end of two to three years, with the higher grades losing the highest proportion of value.

Volume loss the first year is primarily in the small diameter trees and small top logs of larger trees due to cracks and checking from the drying effects of hot summer weather. There is a dramatic volume loss at the end of the second year in ponderosa pine. This is primarily due to the progression from limited deterioration by blue stain to general deterioration due to decay in the relatively large proportion of sapwood during the second year following the fire.

Grand fir, Engelmann spruce and subalpine fir --- Volume loss the first year is primarily in the small diameter trees and small top logs of larger trees due to cracks and checking from the drying effects of hot summer weather. After three years, both merchantable volume and associated value are essentially gone. These thin-barked trees are very susceptible to beetles and sap-rotting fungi. The fir engraver (*Scolytus ventralis*) readily attacks weakened or fire-killed true firs and the spruce beetle (*Dendroctonus rufipennis*) can build up high populations in recently killed spruce. Sap-decaying fungi are readily introduced by these insects and damage rapidly occurs to spruce and true firs.

Diameter

Trees having small diameters (<20") have less physical mass, higher percentage of sapwood, and generally thinner bark than larger diameter trees (local experience indicates that 20" is an appropriate breakpoint classification for small diameter trees on the Wallowa-Whitman National Forest). Because insects, fungi, and checking have a greater physical impact on smaller circumference boles and because smaller trees have a highter percentage of sapwood, loss of merchantability is much more rapid in smaller size classes.

Moisture

Fungi spread most rapidly in a moist environment. Such an environment is found under the bark and within the sapwood of recently killed trees. Too much moisture can retard fungi development by limiting available oxygen and result in bark beetle brood mortality through a condition known as "sour-sap."

Temperature

Most wood decay-causing fungi grow well within a temperature range of 41 to 95 degrees F. The optimum range for growth is 45 to 70 degrees. This temperature range, along with optimum moisture, is a major factor affecting rate of fungal growth.

Aspect and Elevation

These factors are important in that they relate to fungal growth indirectly by affecting moisture and temperature. Higher elevations or north aspects will have a slowing effect on the rate of fungal growth providing the temperature is below 41 degrees F for a significant amount of time.

DETERIORATION PROCESS AND DAMAGING AGENT INTERACTION

Major causes of deterioration are insects, fungi, and weathering. These "agents" can attack trees independently, but usually work together and often affect different portions of trees, depending on the environment that is best suited for their activities.

Insects

Fire-killed and weakened trees are frequently attacked by many insect pests that may be divided into three groups according to the portion of the bole they attack. The first attacking insects are those colonizing the phloem region (bark and cambium). These are bark beetles (*Scolytus spp*, *Ips spp*, and *Dendroctonus spp*), woodborers (usually *Melanophila spp*), and ambrosia beetles (*Trypodendron spp*, *Gnathotrichus spp*, and *Platypus wilsoni spp*). The second group are those attacking the sapwood (*Buprestidae spp*, *Cerambycidae spp*, and occasionally *Siricid spp*) and then finally those attacking the heartwood (usually *Buprestidae spp* and *Cerambycidae spp*).

These insects contribute to wood deterioration by introducing wood decay and stain fungi as well as physically damaging the merchantable wood. Most bark beetles attack weakened trees in the late spring and early summer. Fires that occur after insect flights will result in attacks to fire-killed and weakened timber the year following the burn.

Bark beetles and wood borers initiate the deterioration process. Bark and wood-boring insects will attack weakened trees, causing mortality directly by girdling the trees with larval mines or indirectly by introducing a fungus that develops in the conducting tissues of the tree, blocking the transpiration stream and thus assisting the beetles in girdling the tree. Wood of attacked trees may also be damaged by wood-boring insects during later stages of deterioration.

As beetles develop and feed and fungi colonize the wood, damage starts in the outer sapwood and progresses toward the heartwood around the entire circumference. The heartwood is more resistant to decay than sapwood because it is dryer, harder, and contains compounds that resist stain and decay. Heartwood of most species will eventually deteriorate as a result of insect and fungi activity. This will take a number of years.

Fungi

The damage that results from fungi introduced to trees by initial insect attacks is of even greater significance to the deterioration process.

Fungi deteriorate fire-damaged trees in two ways: some cause wood stains while others cause decay. They enter either directly with insects or through the bore holes and thrive in the warm, moist environment under the bark. Sapwood is the most susceptible portion of the tree and is first to be affected.

Staining, classed as "blue stain," results when spores of the organism causing the stain are introduced into the sapwood of the tree by the invasion of bark beetles. Most common of these fungi are of the genus *Ophiostoma* (*Ceratocystis*) of which there are two types: those present as spores in the mycangium of the insect and those carried in on the exoskeleton.

Blue stain affects the appearance of wood and, because of undesirable color changes of the sapwood, results in lumber degrade and value loss. It attacks sapwood almost exclusively and is most important during the first year following fire before other deteriorating agents cause much damage. It is much more evident in ponderosa and lodgepole pine than in other species.

The fungi colonize the walls and frass in egg galleries and build a network of mycelium which spreads into the phloem and parenchyma tissues of the tree. Unlike decay, staining does not structurally weaken the wood because the fungi live primarily on the contents of the cells, mostly parenchyma (Kimmey 1943). In some areas, however, it is believed that stain can mask other defects (Harvey 1979). Wood with blue stain fungi may also contain wood-decaying fungi.

Weathering

The weather can have both direct and indirect effects on deterioration rates. Checking and cracking of the wood is increased by dry, hot conditions. Thin-barked tops of larger trees, and thin-barked small diameter trees are the first to check and crack. Defoliated trees provide little self-shading and are exposed fully to the sun. Black, scorched tree boles absorb more heat and become very dry. Thin bark loosens and begins to slough off rapidly. Deep checking results in volume deductions. The weather also has an indirect effect on deterioration through its influence on growing conditions for the other deteriorating agents. Very wet or extremely dry weather may limit the number of species of fungi and insects that cause deterioration.

VOLUME AND VALUE DETERIORATION RATES FOR TEPEE FIRE RECOVERY PROJECT

A volume deduction for the loss of small trees and small top logs, and a value deduction for blue stain in pine species will be made based on a probable one year delay between the death of fire-killed trees and harvest.

Volume deterioration needs to be determined so that recovery volumes can be predicted for each EIS alternative.

Value deterioration needs to be determined so the economic analysis reflects actual values resulting from harvest delays.

Volume

A total loss of volume will be assumed for fire-killed trees under 12 inches dbh and for the top 16 foot cruise log on trees where the Girard top (40% of dbh) would be smaller than 10-inch diameter (trees 25 inch dbh or smaller). This volume deduction will be applied to all species. Loss is due to weather related deterioration in the form of deep checks and cracks and from increased chance of breakage.

Small trees and top logs of larger trees are prone to cracking and checking because most have lost their needles and are scorched black, which results in a combination of no shade and heat absorbing conditions. Also, the top log of larger trees is more prone to breakage, since there is less crown mass to pad the impact with the ground.

This volume deduction will be applied to all species.

It's expected that the volume loss because of checking in old-growth tops will be minimal because these tops are usually above the normal merchantable log height (40% of dbh).

There is no volume loss calculated due to rot because it is not expected to occur until the second year.

Value

Value deduction due to blue stain varies according to factors that affect the rate of the blue stain fungi colonization. Fungal colonization and establishment rates have been shown to differ under artificial and natural infection conditions. In a study done by the Forest Research Laboratory, Canadian Forestry Service, Edmonton, Alberta, introduced fungi had begun to sporulate in three days after initiation and in 10 to 14 days had established abundant mycelia (Whitney 1971). Ballard, Walsh, and Cole, of the Plant Anatomy Research Laboratory at Utah State University in Logan, report early penetration and growth of fungal hyphae in an 8- to 10-week period of time following a mountain pine beetle attack in August, 1982, (Ballard 1983).

In a study done on lodgepole pine killed by the mountain pine beetle, trees were sampled each month from August through November, 1976, and again in June, 1977, (Harvey 1979). Harvey concludes that, although blue stain appears during the first 40 days following inoculation, the percent of the tree affected at that time is small, increasing rapidly thereafter (see Table A-1).

Table A-1

Average percentage of blue stain (percentage of tree volume) in mountain pine beetle-killed lodgepole pine in northeastern Oregon

Size Class DBH		Number of Days Since Attack				
cm	inches	[illegible]	40	64	91	288
15	5.9	4.46*	7.83	6.38	22.08	28.08
20	7.8	4.68*	13.16	9.32	32.70	57.22
28	11.0	0.00	17.48	41.76	52.06	65.26
38	14.9	0.00	13.05	43.08	49.56	52.48
48	18.8	0.00	17.55	36.71	15.73**	65.24
Average		1.83*	13.81	27.45	34.43	53.66

*Stain resulting from previous injury
**This low figure does not seem logical, but is listed as published.

A report written by John Dale (Forest Pest Management, USFS, Region 5) indicates 1/4 of sapwood cubic foot volume (CFV) of ponderosa pine is blue stained after the first year (Kimmey 1955).

Other studies done on blue stain in sawed lumber and log decks indicate staining hyphae develop rapidly once fungus has been inoculated. Green lumber graded after a month of close-pile outdoor winter storage showed boards stained on faces and edges (Miller 1988).

Blue stain results in degrade of lumber from selects, shops, and 1 and 2 common to 3, 4, and 5 common (Aho 1984).

For the Tepee Butte Fire Recovery Project, the decision has been made to base the blue stain devalue and economic analysis on the projected time frame that the midpoint of the logging operations will occur in the fall, 1989, approximately one year after the fire. The approach taken involves using the May 1978 Region 6 Amendment No. 288 of the Timber Appraisal Handbook (page 414.47--1) and modifying the table values to adjust for Tepee fire-kill trees being dead only an average of one year, rather than the 2 to 3 years on which the table was developed.

The original table (see Table A-2) was developed from log grade recovery data from Prineville, Oregon (project 45) and John Day, Oregon (project 46). The logs used in these studies varied in years dead, averaging from 2 to 3 years.

Table A-2

Adjustment table for dead ponderosa pine expressed as a percent of values on Table 414.21A of Region 6 Timber Appraisal Handbook.

LOG DIB	GRD. 1	GRD. 2	GRD. 3	GRD. 4&5
09				82
12			77	83
15		52	70	80
18	45	49	63	75
21	41	46	58	69
24	39	45	55	64
27	37	44	52	60
30	35	44	50	57
33	34	44	49	56
36	34	45	50	58
39	35	47	51	58
42	35	49	52	59
45	37	52	54	61
48+	39	56	56	66

The modified table (see Table A-3) will adjust the original table so that the calculated loss for the first year will be 54 percent of the original table value (based on trees dead 2-3 years). This follows the recommendation of Willits 2/ since it produces a value deduction of $150.63 per thousand board feet deemed reasonable by Willits and timber industry representatives who made comments during the Tepee Butte Project scoping process.

Table A-3

Modified adjustment table for dead ponderosa pine expressed as a percent of Table 414.21A. (Loss at 54% of original adjustment table)

LOG DIB	GRD. 1	GRD. 2	GRD. 3	GRD. 4&5
09				90
12			88	91
15		74	84	89
18	70	72	80	87
21	68	71	77	83
24	67	70	76	81
27	66	70	74	78
30	65	70	73	77
33	64	70	72	76
36	64	70	73	77
39	65	71	74	77
42	65	72	74	78
45	66	74	75	79
48+	67	76	76	82

Basically, the modified table will be used to adjust ponderosa pine Selling Values listed on Table 414.21A (Region 6 Forest Service Handbook Amendment 416, dated November, 1988) of the Timber Appraisal Handbook (see Table A-4). The Handbook table is based on data provided by operators and, as such, reflects the amount of degrade that occurs in average operations, not fire salvage.

Table A-4

Selling value table and stand valuation summary for ponderosa pine.

DIB IN.	GRD 1	GRD 2	GRD 3	GRD 4	GRD 5	TOTAL VOL-UME	MFG. COST 1/
06	value volume				$518	$462	$144
09	value volume				$518	$462	$144
12	value volume			$513	$504	$447	$153
15	value volume		$769	$563	$483	$450	$148
18	value volume	$961	$817	$608	$472	$472	$144
21	value volume	$995	$860	$648	$507	$507	$140
24	value volume	$1,019	$893	$678	$545	$545	$137
27	value volume	$1,043	$924	$705	$583	$583	$135
30	value volume	$1,059	$947	$721	$612	$612	$133
33	value volume	$1,080	$971	$736	$629	$629	$132
36	value volume	$1,093	$986	$742	$620	$620	$131
39	value volume	$1,098	$995	$742	$636	$636	$130
42	value volume	$1,107	$1,006	$742	$647	$647	$130
45	value volume	$1,104	$1,009	$737	$646	$646	$130
48	value volume	$1,114	$1,018	$749	$628	$628	$130

TOTAL VALUE
TOTAL VOLUME
% BY LOG GRADE

Average selling value and mfg. cost per MBF L.S. $ _____; $ _____2?
1/ Chip and by-products not included.
Computation of avg. mfg. cost: (avg. mfg. cost $ _____/MLS 2/ x
Adj. factor _____ 3/)+(Chip & by-product mfg. cost *-4.96* x _____ adj.
Factor 3/)+ $ _____
Species avg. mfg. cost $ _____/MLS
3/ See Table 416.41 appendix for adj. factors.

It will be necessary to develop a selling value for the dead component and a separate selling value for the severe fire-damaged component that is still alive. The two selling values will then be weighted together using the appraised volumes of the dead and live (severe fire-damaged) trees. Ponderosa pine with no blue stain would have a valuation of $638.52 per thousand board feet (see Table A-5).

Table A-5

Ponderosa Pine Valuation Summary, Adjusted Selling Value.

LOG DIB	GRD.1 (1S)	GRD.2 (2S)	GRD.3 (3S)	GRD.4 GRD.5 (4S) (5S)
6	.00	.00	.00	.00 26.62
9	.00	.00	.00	.00 71.86
12	.00	.00	7.91	.00 133.64
15	.00	3.30	15.57	.00 225.92
18	18.65	.00	44.47	.00 253.96
21	19.96	31.13	90.96	.00 239.94
24	39.86	9.31	50.78	.00 176.39
27	28.13	24.28	67.28	.00 156.46
30	41.97	22.97	92.27	.00 51.83
33	49.86	40.64	16.03	.00 34.97
36	26.64	15.18	10.76	.00 12.69
39	16.48	.00	.00	.00 .00
TOTALS	241.55	146.81	396.03	.00 1384.28
% VOLUME	11.1	6.8	18.3	.0 63.8

2168.67 MBF TOTAL VOLUME PRICED

SELLING VALUE SCHEDULE		APPENDIX
1353810.45 TOTAL LBR SELLING VALUE	1188	414.21A
624.26 LBR VALUE/MBF		
1.005 LBR VALUE-ADJUSTMENT (FRF)	1188	414.51A
627.38 (ADJ) LBR VALUE/MBF		
11.14 CHIP VALUE/MBF	1188	414.14A
638.52 TOTAL SELLING VALUE/MBF		

MANUFACTURING COST (ADJ TO MAY, 1988)

303517.21 TOTAL LBR MFG COST	1188	414.21A
139.96 LBR COST/MBF		
1.00000 LBR COST-ADJUSTMENT		
139.96 (ADJ) LBR COST/MBF		
6.01 CHIP COST/MBF		
1.00000 CHIP COST-ADJUSTMENT		
6.01 (ADJ) CHIP COST/MBF		
145.97 TOTAL MANUFACTURING COST/MBF		

Table A-6
Adjusted Selling Value for Ponderosa Pine
(Loss at 54% of original adjustment table)

OG IB	GRD.1 (1S)	GRD.2 (2S)	GRD.3 (3S)	GRD.4 (4S)	GRD.5 (5S)	ADJ. VALU
6	0	0	0	0	90 518 26.62	90 462 11103.03
9	0	0	0	0	90 518 71.86	90 462 29972.34
12	0	0	513 7.91	88 504 0	91 447 133.64	91 57807.06
15	0	3.3	74 769 15.57	84 563 0	89 483 225.92	89 450 99910.04
18	18.65	70 961 0	72 817 44.47	80 608 0	87 472 253.96	87 472 137922.0
21	19.96	68 995 31.13	71 860 90.96	77 648 0	83 507 239.94	83 507 179357.3
24	39.86	67 1019 9.31	70 893 50.78	76 678 0	81 545 176.39	81 545 136589.6
27	28.13	66 1043 24.28	70 924 67.28	74 705 0	78 583 156.46	78 583 141660.1
30	41.97	65 1059 22.97	70 947 92.27	73 721 0	77 612 51.83	77 612 116939.2
33	49.86	64 1080 40.64	70 971 16.03	72 736 0	76 629 34.97	76 629 87504.12
36	26.64	64 1093 15.18	70 986 10.76	73 742 0	77 620 12.69	77 620 41173.81
39	16.48	65 1098 0	71 995 0	74 742 0	77 636 0	77 636 11743.68
TOTALS % VOLUME	241.55 11.1	146.81 6.8	396.03 18.3	0 0	1384.28 63.8	1051682. $484.94

2168.67 MBF TOTAL VOLUME PRICED

*** SELLING VALUE	SCHEDULE APPENDIX ***
TOTAL LUMBER SELLING VALUE	1188 414.21A
$484.94 LBR VALUE/MBF	
1.005 LBR VALUE-ADJUSTMENT (FRF)	1188 414.51A
$487.37 (ADJ) LBR VALUE/MBF	
$0.00 CHIP VALUE/MBF	1188 414.14A
$487.37 TOTAL SELLING VALUE/MBF	

*** 1988 ***
303517.21 TOTAL LBR MFG COST — 1188 414.21A
139.96 LBR COST/MBF
1 LBR COST-ADJUSTMENT
139.96 (ADJ) LBR COST/MBF
0 CHIP COST/MBF
1 CHIP COST-ADJUSTMENT
0 (ADJ) CHIP COST/MBF
139.96 TOTAL MANUFACTURING COST/MBF

When modified values (Table A-3) are applied to selling values (Table A-4), the resulting valuation summary (Table A-6, page 11) shows a total selling value per thousand board feet of $487.37 for the blue stained pine species. This revised value is $150.63 less than unstained ponderosa pine.W

The previously cruised Bluebird Timber Sale (partially within the Tepee Butte Fire Area) was used to provide a sample log-stock table to determine the percentage of volume that occurs in each log grade.

No value for clean chips is assumed since most logs to be removed will have either charred wood or scorched bark which would contaminate this product.

FOOTNOTES

1/ Personal communication from Sue Willits, Forestry Science Laboratory, Timber Quality Research, Portland, Oregon, to Robert Northman, Assistant Timber Staff, Wallowa-Whitman National Forest.

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APPENDIX B

WATERSHED AND FISHERIES CUMULATIVE EFFECTS ASSESSMENT

ENVIRONMENTAL EFFECTS ANALYSIS PROCESS

Soil, Water, Fish and Riparian Vegetation

TEPEE BUTTE FIRE RECOVERY PROJECT
By
Kenwood Hauter, Hydrologist
Dan Harkenrider, Soil Scientist
Rich Gritz, Fisheries Biologist

Contents:

I Background and Legal Direction
II Recovery of Riparian Vegetation
III Stream Shade and Temperature
IV Allochthonus Input and Bank Stability as Fish Habitat Indices
V Sediment Yield
VI Long-term Site Productivity
VII Turbidity in Forest Streams
VIII Rain-Induced Peak Streamflow
IX Snowmelt-Induced Peak Streamflow
X Nutrients in Streams
XI Effects on Fish
XII Dissolved Oxygen in Forest Streams
XIII Data tables for Sediment, Water Temperature and Dissolved Oxygen -- listed by alternative

I. BACKGROUND AND LEGAL DIRECTION

The Council on Environmental Quality (CEQ) regulations require that all Federal agencies consider cumulative impacts in environmental analyses. Cumulative effects are those that result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency of person undertakes such actions. Cumulative impacts can result from individually minor, but collectively significant actions, taking place over a period of time (40 C.F.R. 1508.7). Section 208 (b) (2) (F) of the Clean Water Act of 1977 (91 Stat. 1566) requires that cumulative effects be mitigated "to the extent feasible" to avoid adverse cumulative soil and water effects. (33 USC 1288 (b) (2) (F) (1982)). In addition, the objective of the Federal Water Pollution and Control Act Amendments of 1972 (86 Stat. 816) was to "restore and maintain the chemical, physical and biological integrity of the Nation's waters". (33 USC 1251 (1982)).

The interdependence of streams, watersheds and geomorphic processes greatly complicates the assessment of biological and physical effects of management actions within a watershed. Many effects occur both at the site of the action and at points distant from the action in both space and time.

Some watershed impacts associated with activities can be imperceptible for many years, becoming of consequence when large storms and floods act on the altered watershed condition. The resultant effects influence watershed condition, stream processes, soil productivity and the biological systems which depend on these resources.

Even with intensive research it is often difficult to show definite, cause and effect relationships. A large number of watershed attributes and specific locations are needed to track the cumulative effects of many activities which occur in a watershed. Complicating this is the diversity of soils, topography, and vegetation as well as spatial and temporal diversity of activities. Finally, this complex set of interactions is overlaid with natural disturbances to the system by wildfires, floods, windstorms, and related phenomena. The larger the area and the longer the time period involved in the analysis, the less likely it is that a particular management impact/watershed interaction has been researched, and the more likely it is that the phenomenon is poorly defined.

Where data and appropriate models were available, impacts of the fire and predicted effects of alternative recovery strategies on several watershed components were assessed:

-- The modeling process was performed for each of three land conditions:

  * Pre-fire (in most cases, this was judged to be near pristine).
  * Post-fire with no recovery activities.
  * Post-fire with recovery activities.

-- For both post-fire conditions, data were analyzed and displayed according to:

  * yearly effects over a 10-year period.
  * average 10-year effect.
  * ten year recurrence interval (rainfall, peakflow, and lowflow events).
  * fifty year recurrence interval (rainfall and peakflow events). This represents analysis of impacts which may have catastrophic consequences (40 CFR 1502.22).

In order to expedite the analysis process, the project area was divided into a 72 subwatersheds based on topographic boundaries and proximity to anticipated recovery activities. This facilitated analyzing effects on localized areas as well as combined effects on the project area as a whole.

When the information necessary to complete a quantitative assessment of watershed impacts is either incomplete or unavailable, watershed specialists are allowed to estimate effects if they describe the reliability of those estimates (40 CFR 1502.22). They can also predict what may be required to prevent adverse consequences of proposed activities with a high level of confidence. These measures are referred to as Best Management Practices and have been shown to be effective in meeting Oregon State water quality standards. For the Tepee Butte Recovery Project, two kinds of BMPs were prescribed:

* those capable of providing a high probability of *preventing any* degradation of parameters identified in Oregon State water quality regulations. There will be no cumulative effects. This kind of BMP was selected when there was incomplete information.

* those capable of providing a high probability of being *in compliance* with Oregon State water quality regulations. These were usually more restrictive than normal because of the initial adverse fire impacts, and they were at least equal to or safer than the BMPs specified by the Rules associated with the Oregon Forest Practices Act. When this type of BMP was used its effects were assessed through a cumulative

effects analysis. This kind of BMP was selected when "complete" modeling information was available.

A description of BMPs and their application is included in Appendix D.

The following is a summary of the watershed environmental effects analysis process. For those reviewers wanting to see a more complete description of the process, the complete process paper is on file at the Tepee Butte Recovery Project Office in Baker, Oregon.

II. RECOVERY OF RIPARIAN VEGETATION

Riparian vegetation primarily affects:

- stream shade and stream temperature.
- allochthonous input (insects, leaves, branches etc.) to stream systems.
- bank stability.
- habitat for non-aquatic wildlife species.
- forage and cover for livestock, deer and elk.
- access of livestock, deer and elk to streambanks.

A. Pre-Fire

Infrared aerial photography taken in August of 1988 was used to determine the density and composition of riparian vegetation along all Class I, II, and III streams before the fire.

The majority of stream sections within the project area were found to be occupied at their ecological potential. Riparian stands were further defined into four classes based on the relative mix of deciduous (willow, cottonwood, alder, etc.) and coniferous (Douglas-fir, grand fir, etc.) vegetation:

Class A - 90-100% deciduous; 0-10% coniferous
Class B - 51-89% deciduous; 11-49% coniferous
Class C - 30-50% deciduous; 50-70% coniferous
Class D - less than 30% deciduous; greater than 70% coniferous

The accuracy in correctly classifying the riparian vegetation is rated excellent. The infrared photos clearly displayed the difference between coniferous and deciduous vegetation. The accuracy in estimating pre-fire riparian vegetation crown cover is also excellent. Aerial photo interpretation is supported by Oregon Department of Fish and Wildlife stream surveys for the Tepee Butte area.

B. No Action Alternative

Post-fire true color aerial photographs taken in October of 1988 and fire intensity maps produced from field data were used to determine burn intensity within the riparian areas of all Class I, II, and III streams. Accuracy of fire intensity mapping is rated good.

Maps were produced showing vegetation class and burn intensity within the riparian area of Class I, II, and III streams in the Cherry, Cook, Cottonwood, Horse, Lent, Eureka and Knight Creek watersheds. Stream sections were defined according to the combination of vegetation class, burn intensity, and stream class. Section breaks were also defined at major tributary junctions.

Tree and shrub mortality and shrub recovery rates were determined for each level of burn intensity. Post-fire stand condition data were consulted to determine typical tree mortalities for different burn intensities. Mortality was assumed to correlate directly to burn intensity. Recovery of deciduous vegetation was estimated after review of literature on fire resistance of shrubs (Noste and Bushey 1987 and Kovalchik 1987) and based on experience of professional siviculturists and hydrologists. The following mortality and recovery rates were then applied to the different burn intensities:

Low :	20% loss of deciduous vegetation initially, full recovery in 3 years, 20% loss of conifers, no recovery in 10 years
Moderate:	40% loss of deciduous vegetation initially, full recovery in 5 years 50% loss of conifers, no recovery in 10 years
High:	90% loss of deciduous vegetation initially, full recovery in 10 years 100% loss of conifers, no recovery in 10 years

C. Alternatives Which Include Planting Of Riparian Vegetation

None of the proposed alternatives would result in removal of vegetation within the riparian areas of Class I, II, or III streams. Therefore, alternatives which include planting of shrubs in riparian areas would increase the rate of recovery in crown cover above that predicted under the No Action Alternative.

Growth rates for shrubs (native stocks of willow, cottonwood, etc.) were estimated based on growth observed on similar sites. It was estimated that shrubs would achieve 3-foot diameter crowns in four years and 6-foot diameter crowns in nine or ten years. Where shrubs are planted at 8-foot by 8-foot spacing, 11 percent crown cover would be achieved in 1993, and 44 percent crown cover would be achieved by 1998.

Stream sections to be planted were determined using the allochthonous input variable from the U.S. Fish and Wildlife Service rainbow trout habitat suitability index (see part IV of this paper). This index dropped below 1.0 in all areas where high intensity burns occurred and where a moderate intensity burn occurred in vegetation class D. These highly damaged riparian areas are where reduction in crown cover would be greatest initially, and slowest to recover naturally.

Accuracy of this estimate is fair. Predicted increase in crown cover of planted shrubs over a ten-year period is based on professional experience. Climatic factors and site productivity will influence actual tree growth. Furthermore, 8 x 8-foot spacing may not be achievable if poor planting sites are encountered.

D. Alternatives Which Do Not Include Planting Of Riparian Shrubs

Since none of the alternatives would harvest timber within 200 feet of a Class I, II, or III stream, recovery of riparian vegetation would be the same as the natural rate of recovery predicted for the No Action Alternative.

III. STREAM SHADE AND TEMPERATURE

Stream temperature is an important determinant of water quality. Temperature controls not only the metabolic rates and functions of aquatic biota; but also serves to maintain community structure (U. S. Forest Service 1980). Brown (1970) established that direct solar radiation impinging on the stream surface is the primary cause of stream heating. While the accounting of various energy exchanges which occur in a natural stream can be exceedingly complex, the simple model which Brown (1970) developed does provide good accuracy estimates of the maximum potential daily temperature increase associated with loss of stream shading.

Brown's model, however, was developed for use on stream segments less than 2000 feet long. In order to apply the model to an entire watershed, the equation was modified using the mixing formula suggested by Brown. Exposed lowflow water surface area was summed for each analysis area and used in Brown's equation with the basin discharge as the denominator. This equation was developed for analysis of impacts of the Silver Fire on the Siskiyou National Forest (Vanderheyden et al. 1988) with good success. Predicted stream temperatures for pre-fire conditions were within 1 degree Fahrenheit of measured temperatures in the Silver Creek watershed. Figure 3 shows Brown's equation and the modified version developed by Vanderheyden and others (1988) which was used for modeling stream temperature increases.

A number of assumptions and estimates are required to use the model in this fashion. They include:

> Absorbed Solar Radiation and Travel Time - A flow velocity of 0.5 feet per second was assumed. In reality, this value would be highly variable depending on stream gradient, roughness, etc; however, the value only enters calculations in determination of the absorbed solar radiation constant and the relationship is very flat. Large differences of travel time yield only small changes in the absorbed radiation constant.
>
> Bedrock was estimated at 5 percent for all streams. Bedrock can act as a heat sink in small streams, however, large percentages of bedrock in the stream are required to significantly affect the heat load.
>
> Travel time from the basin headwaters to the mouth and groundwater inflow were not determined or analyzed. Topographic shading was assumed to be insignificant during the critical part of the day, when the solar angle is 60 degrees. These assumptions may result in an overestimation of heat load in some stream sections.

Use of Brown's equation for calculating stream temperature changes:

Eq 1 $$T = \frac{H \times A \times 0.000267}{Q}$$

where:
T = stream temperature change, degrees F
H = rate of heat input per unit area (constant for given latitude and stream velocity)
A = total unshaded stream surface area
Q = stream discharge, cubic feet per second

Eq 2 $$T_d = \frac{Qt_1 \times Tt_1 + Qt_2 \times Tt_2}{Qt_1 + Qt_2}$$

where:
T_d = downstream temperature change
Qt_1 = discharge of tributary 1
Qt_2 = discharge of tributary 2
Tt_1 = tributary 1 temperature
Tt_2 = tributary 2 temperature

Change at mouth of the basin:

Substitute Eq 1 into Eq 2 for T

Eq 3 $$T\text{ basin} = \frac{Qt_1 \dfrac{(H \times A \times 0.000267)}{Qt_1} + Qt_2 \dfrac{(H \times A \times 0.000267)}{Qt_2} + \text{etc}}{Qt_1 + Qt_2 + \text{etc. (Q for the basin)}}$$

Eq 4 $$T\text{ basin} = \frac{At \times H \times 0.000267}{Qt}$$

where:
At = total exposed area of stream in basin
Qt = flow at point of interest

Eq 5 Temperature at the Basin mouth = 45 F + T basin

A. Pre-Fire

Lowflow stream widths were estimated for each stream section by extrapolating information obtained by the Oregon Department of Fish and Wildlife (ODF&W) during stream surveys conducted in March-May, 1976 on Cherry and Cook Creeks, and in May, 1966 on Cottonwood Creek. Stream sections, as defined in part II, are defined according to riparian vegetation composition and burn intensity. The total stream surface area exposed in each watershed was determined by multiplying the section length by width and applying a transmission factor based on the crown cover calculated in part II. Figure 4 from US Forest Service 1980 shows the relation between transmission and crown cover.

Lowflow was determined for each watershed using the formula for 7-day lowflow with a ten-year recurrence interval developed for eastern Oregon (Lystrom 1980). Variables used in the equation include drainage area, storage, forest cover, annual precipitation, and soils index value.

Maximum potential daily temperatures for the three streams were then calculated by adding the temperature increase predicted by the model to the groundwater temperature. Groundwater temperature was determined to be equal to the average annual air temperature (45 degrees F at Enterprise, Oregon). This estimate meshed with measured spring temperatures ranging from 40 to 59 degrees F during the 1966 ODF&W stream survey on Cottonwood Creek. Significant contributions by springs to surface flow in Cottonwood Creek were identified by the survey crew. The mixing equation (Eq 2) was used to account for this input when temperature calculations were performed on Cottonwood Creek.

The maximum temperature measured on Cottonwood Creek above the mouth of Basin Creek was 68 degrees F when the air temperature was 110 degrees F in July, 1967. This matches the predicted daily maximum temperature at the fire boundary on Cottonwood Creek.

Accuracy of these pre-fire, maximum daily temperature predictions is rated good for Cottonwood Creek and fair for Cherry and Cook Creeks. The measured high temperature in Cottonwood Creek in 1966 should represent a maximum in 1988 since shade has increased considerably due to improved range management in the riparian area. Due to lack of site specific data for lowflow stream widths and measured temperatures for calibration of Cherry and Cook Creeks, the predicted stream temperatures should be used as baselines from which to predict change instead of known values.

B. No Action Alternative

Loss of forest cover after the fire will result in increased summer lowflows due to reduction in evapotranspiration. In particular, lowflow discharge can experience dramatic percentage increases. The increased lowflow represents a larger volume of water to heat, but also results in a wider stream surface, exposing more surface area to direct solar radiation.

Increased lowflows were determined after the fire by reducing the percentage of forest cover in the lowflow equation (Lystrom 1970) according to the acres of high-intensity burn in the watershed. Increased stream widths were then estimated based on the new flows. Increased stream widths were applied only to sections downstream of areas which suffered considerable tree mortality.

Change in crown cover was determined for each section as discussed in section II. Transmission of solar radiation was determined for the new crown cover according to Figure 4, from US Forest Service 1980. Then, total stream surface area exposed was calculated for each section and summed for the entire watershed. Surface area exposed for each watershed was then used with the increased lowflow to determine the new stream temperature. Stream temperatures were calculated for years 1, 3, 5, and 10 following the fire.

In Cherry Creek watershed, where 25 percent of the watershed burned at a moderate- or high-intensity, partial recovery of lowflow discharge and width was assumed for year 5 and full recovery by year 10. Reduction in lowflow discharge would be due to regrowth of phreatophytes (willow, cottonwood, etc.) along the stream banks. In

Cook and Cottonwood Creeks, where 35 and 46 percent of the watersheds, respectively, were burned at a moderate- to high-intensity a partial recovery of lowflow was assumed for year 10.

Due to the large percentage of the watershed burned and low summer base flow in Cook Creek, the predicted temperature for the first year after the fire was extremely high (95 degrees). It is likely that there is a maximum, equilibrium temperature that actual stream temperatures will not exceed (US Forest Service 1980). Because nighttime cooling has not been accounted for in the model, predicted values exceed this equilibrium temperature. An estimate of the maximum, equilibrium temperature was obtained by examining the mean daily maximum temperature for August. For the project area, this temperature was determined to be 88 degrees Fahrenheit. When predicted temperatures exceed this equilibrium temperature, a value of 88 degrees F will be assumed.

Post-fire, maximum stream temperatures were not calculated for Eureka or Knight Creeks. These areas were lightly touched by the fire, do not support fish populations, and are largely within land allocations which preclude timber harvest. Furthermore, there is some uncertainty as to whether these streams flow yearround.

Since Cook, Cherry, Eureka, and Knight Creeks comprise less than 1 percent of the flow in the Snake River, no downstream, cumulative effect from temperature increases in these streams will occur.

Less than 1 percent of the riparian area in Cold Spring Creek, a tributary to Horse Creek which flows into lower Cottonwood Creek, burned at a low-intensity. No significant, direct impacts on stream temperature from the fire are expected in these streams. Approximately 1.1 miles of riparian vegetation burned along Lent Creek at a low- to moderate-intensity. While the maximum daily temperature in this stream, which is entirely on private land, will likely be increased for several years after the fire, the summer base flow is too small to significantly influence maximum stream temperatures in lower Cottonwood Creek.

The mixing equation (Eq 2) was used to evaluate the cumulative effects on stream temperature in the portion of Cottonwood Creek downstream of the fire area and in Joseph Creek. Streamflow and maximum daily temperature on lower Cottonwood and Joseph Creeks were estimated from measurements made in July, 1967 when the air temperature was 110 degrees F (Smith 1975).

C. Alternatives Which Include Planting Of Riparian Vegetation

In order to meet State of Oregon water quality standards and Forest Service direction for no degradation of water quality in Class I streams, none of the proposed alternatives would remove vegetation within 200 feet of any Class I, II, or III stream.

Crown covers predicted in section II, C. were used to compute reduction in total stream surface area exposed due to planted riparian vegetation. Increased crown cover due to planting of shrubs would not effectively provide shade to the stream surface until 1998 (year 10). Stream surface area exposed was reduced by the additional percentage crown cover provided by shrubs, to determine the maximum daily temperature in year 10 after the fire under these alternatives.

Accuracy of predicted stream temperatures is rated fair due to error inherent in estimating crown cover and stream widths, and error involved in estimating growth of the planted trees.

D. Alternatives Which Do Not Include Planting Of Riparian Vegetation

Since none of the proposed alternatives would harvest timber within 200 feet of any Class I, II, or III stream, stream temperatures would not be elevated beyond those predicted under the No Action Alternative. Recovery in stream temperatures over time would also be the same as under the No Action Alternative.

IV. ALLOCHTHONOUS INPUT AND BANK STABILITY AS PART OF THE RAINBOW TROUT HABITAT SUITABILITY INDEX

The rainbow trout habitat suitability index (Raleigh et al. 1984) was applied to determine impacts of fire and proposed management activities on trout habitat. This index produces a relative indication of habitat suitability by deriving several variables to evaluate different components of trout habitat and water quality.

A. Allochthonous Input

Allochthonous input (leaves, twigs, insects, etc.) is an important source of nutrients in cold, unproductive trout streams (Raleigh et al. 1984). The vegetation index (*V11*) for allochthonous input is based on crown cover of shrubs, grasses and trees along the streambank.

1. **Pre-Fire** -- Pre-fire crown cover and vegetation classes described in section II were used to determine the percent crown cover of trees and shrubs. Crown cover of grasses was assumed to be a uniform 20 percent in all vegetation classes. The suitability index was equal to 1.0 in all stream sections prior to the fire.

2. **No Action Alternative** -- Post-fire rehabilitation seeding completed in the fall of 1988 in moderate- and high-intensity burn areas on steep slopes was estimated to produce 50 percent grass the first year after the fire. This percentage was assumed to persist until overstory crown cover recovered to greater than 70 percent.

   Following the fire, the vegetation index (allochthonous input) improved under vegetation classes B, C, and D, as compared to pre-fire conditions. This was because the index weights shrubs as twice the value of trees; therefore, since trees were killed by the fire and would not recover in the 10-year analysis period, crown cover of shrubs will increase to greater than pre-fire conditions. Similarly, the rehabilitation seeding of grasses has increased the density of grass over pre-fire conditions. Rate of improvement depended on burn intensity. However, once the vegetation index is greater than 150, the suitability index reaches 1.0; further increases in the vegetation index do not improve the suitability index. Therefore, since the suitability index is equal to 1.0 prior to the fire in all watersheds, it does not reflect the improvement in the vegetation index following the fire.

The suitability index became less than 1.0 (ideal) for several years after the fire in all vegetation classes where high-intensity burns occurred. In vegetation class D (70 percent or more conifer) the index dropped below 1.0 under the moderate-intensity burn the first year following the fire. Figure 1 shows the length of stream within each watershed where the allochthonous input index fell below 1.0 following the fire.

Figure 1. Length of stream (in feet) where post-fire allochthonous input is less than 1.0

	Vegetation and Burn Class					
Watershed	A3	B3	C3	D3	D2	Total
Cherry	530	0	0	1,450	17,560	19,540
Cook	400	0	7,920	13,340	10,830	32,490
Cottonwood	1,190	6,860	3,430	34,590	23,100	69,170

When the vegetation index was aggregated for all Class I, II, and III streams in each watershed, however, the suitability index was not responsive to changes in short sections of the larger stream systems. The suitability index remained at 1.0 in Cherry and Cook Creek watersheds for all years following the fire. It dropped to 0.9 the first year after the fire in Cottonwood Creek watershed, returning to 1.0 by year 3.

3. **Alternatives which include planting of riparian vegetation** -- The suitability index highlights areas where riparian planting is needed to speed the recovery of allochthonous input. Shrubs would be planted in all "severely damaged" riparian areas listed in Table 1. Growth estimates for the planted shrubs are described in section II.

   Planting of shrubs in riparian areas would result in the suitability index reaching 1.0 within five to ten years in all stream sections.

4. **Alternatives which do not include planting of riparian vegetation** -- Since none of the alternatives would include timber harvest within 200 feet of any Class I, II, or III stream, the suitability index would be the same as for the No Action Alternative.

B. Bank Stability

Streamside vegetation is an important means of controlling soil erosion, a major source of fine sediment in streams (Raleigh et al. 1984). The habitat suitability model assesses bank stability (V_{12}) using the percent rooted vegetation and stable rocky ground cover.

1. **Pre-Fire** -- Rocky ground cover was estimated at 5 percent for all three streams based on a post-fire field review. Percent rooted vegetation was assumed to correspond to total crown cover determined in section II (95 percent for Cook and Cherry Creeks, 92 percent for Cottonwood Creek). The rooted vegetation index was 1.0 (ideal) for all streams prior to the fire.

2. **No Action Alternative** -- Percent rocky ground cover remained at 5 percent, and percent rooted vegetation was assumed to correspond to total crown cover determined in section ii. Figure 2 shows the rooted vegetation suitability index for 10 years after the fire for each stream system.

Figure 2. Rooted Vegetation Suitability Indexless than 1.0

Watershed	Year 0	Year 1	Year 3	Year 5	Year 10
Cherry	1.0	1.0	1.0	1.050	1.0
Cook	1.0	.85	.95	1.0	1.0
Cottonwood	1.0	.60	.78	.85	1.0

3. **Alternatives which include planting of riparian vegetation** -- Percent rooted vegetation would increase significantly by year 10 where shrubs are planted. However, since the suitability index is at 1.0 in year 10 for all three streams, it does not reflect the benefit of planting shrubs for bank stability.

4. **Alternatives which do not include planting of riparian vegetation** -- The rooted vegetation suitability index would be the same as for the No Action Alternative.

V. SEDIMENT PRODUCTION

The quantitative value of sediment yielded from various Tepee Butte watersheds is needed for later estimation of the sediment effects of the fire and of project implementation on fish habitat/production and turbidity. The following is a discussion describing the process that yields quantitative values for sediment yield.

The discussion headings are:

A. **General Sediment Yield**
B. **Adjustments To General Sediment Yield For Tepee Butte Watersheds**
C. **Quantifying Sediment Yield For Tepee Butte Watersheds**
D. **Surface Soil Erosion Modeling**
E. **Sediment Delivery To A Streamchannel**
F. **Natural/Pristine Sediment Yield**
G. **Adapting Natural Sediment Yield For Use In Predicting Effects On Fish Habitat And Fish Numbers**
H. **Determining The Increase In Sediment Yield Over Natural Yield For Fish Predictions**

For a full description of sediment yield and soil erosion modeling see the Watershed Environmental Effects Analysis Process Paper, which is on file in the Tepee Butte Fire Recovery project files and is available on request.

A. General Sediment Yield

Every sediment particle which passes a particular point in a stream must satisfy the following two conditions: (1) It must have been produced somewhere in the watershed above, either on the hillside or within the channel; (2) once the particle reaches or is produced in the stream, it must be transported by the streamflow to the point (Chow 1964, p. 17-36). These processes don't all happen at the same rate, therefore a component for changes in storage must be added if short-term (few 10's of years) analysis at the cross section is required.

From above, for short-term analysis for any stream cross section:

Eq(1) Sediment yield = (transport) hillside erosion that has reached channel
+ channel bedrock degradation
+ change in temporary channel storage of the two previous components

Considering stream systems, sediment is particles derived from rocks which are transported by, suspended in, or deposited by streamflow or mass movement directly into the streamcourse. Ordinarily this excludes ice or floating organic material.

Sediment yield is the total sediment volume being moved in a stream past any given point during a specified period of time.

Erosion and degradation, as being used here, define the same process. Each describes the removal of soil and rock from its exact place of origin on the land surface. Once it moves off its point of origin it generally will be detained (for up to a few 10's of years) as storage on the hillside before it reaches a streamchannel, and as the channel storage component in the above equation. If these processes were not occurring, only clear water with no contained sediment would enter the streamchannel.

Hillside erosion equals (1) the removal of soil by water erosion, and (2) the removal of soil through mass movement.

Channel bedrock degradation is the removal of streambed material that was originally bedrock underlying the channel. The rate of removal equals the rate that the bedrock is broken-down into rock particles that are small enough to be transported away by streamflow. Channel bedrock and its gradually smaller components are primarily broken down by chemical reactions, freeze/thaw and abrasion bv moving water and rock particles.

B. Adjustments To General Sediment Yield For Tepee Butte Watersheds

Following is a discussion of how the sediment yield (Equation (1)) is further simplified for use on Tepee Butte project streams.

1. **Hillside erosion** -- As stated above, hillside erosion includes the removal of soil by mass movement processes -- for Tepee Butte watersheds, mass soil movement has not been and will not be a significant factor in contributing to hillside erosion. Soil mass movement will be discussed in more detail under section D.

   The above discounting for the influence of soil mass movement, leaves just the removal of soil by water erosion as a component of hillside erosion, ie. hillside erosion becomes surface soil erosion.

2. **Channel bedrock degradation** -- Soil mass movement in other non-Tepee Butte watersheds is often a major contributor of large rocky material (gravel, cobbles) to streamcourses. With the absence of significant soil mass movement in the Tepee Butte watersheds, only channel bedrock degradation can be a source of these large rocky materials in Tepee Butte streams.

   Inventories by the now Oregon Department of Fish and Wildlife (Oregon Dept. of Fish and Wildlife 1976) show considerable deposits of gravel and larger components throughout the fish-bearing streams of the area. Other observations of non-fish streams made just after the wildfire also show considerable amounts. These deposits may either be degraded bedrock that is still in place where formed, or they may be degraded bedrock (smaller portions) that has moved downstream. If it has moved downstream, it is part of the "change in temporary channel storage" component shown in Equation (1). In terms of a mass continuity equation it is no longer called channel bedrock degradation.

   From the above, for short-term analysis of any Tepee Butte stream cross section:

   Eq(2) Sediment yield = surface soil erosion that has reached a channel
   + channel bedrock degradation
   + change in temporary channel storage of the two previous components

   Tepee Butte streamcourses have a high component of large bedrock residuum ie.gravel, cobble, boulders. The fact that the rocks exist (and mass soil movement is not a factor in their existence) suggests that streamflow is not consistently high enough to remove/transport this material out of the stream system. This suggestion becomes a reality when it is compared to Chow's 1964 statement. He states (p. 17-36) that the movement of the course components of sediment yield are limited by the transporting ability of the streamflow -- streamflow is not high enough, long enough each year. He goes on to state that this coarse, rock size part of total sediment yield is called bed-material load. For use in this EIS process and to conform with other references discussed later, this name has been shortened to just "bedload".

In terms of Equation (2), bedload thus becomes the total rate of channel bedrock degradation combined with the rate, negative or positive, of change of the displaced degraded bedrock component of "change in temporary channel storage".

Surface soil erosion that has reached a channel is also called and has been shortened to just "sediment delivery".

Using the results of this section's discussion, and emphasizing rate units, yields:

For short-term analysis of any Tepee Butte stream cross section:

Eq(3) Sediment yield = sediment delivery rate
+ bedload rate
+ rate of change in temporary channel storage of the soil erosion component

C. Quantifying Sediment Yield For Tepee Butte Watersheds

Sediment delivery of surface soil erosion to a streamchannel is determined by the soil scientist, using procedures described in section E.

Geologic degradation of bedrock on the hillside results in a full range of degraded rock sizes -- clay, silt, sand, gravel, cobble and boulder sizes. Generally, soil erosion moves/removes just the clay and silt particle sizes. Soil erosion almost never moves the gravel, cobble and boulder sizes. They are simply still too large to be moved by the low volume/force of soil surface runoff water produced by rainstorm or snowmelt runoff events.

During unusual high-intensity events (10 to 100 year frequency), sand is delivered to streamcourses from concentrated runoff erosion of deep rills and gullies (little is stored on the hillside itself). Additional sand sizes are supplied from headcutting soil in the bottom of ephemeral draws during these extreme events. The calculated rate of sediment delivery is the average rate that would occur over long periods of time (100s of years) for the given erosion-producing condition that is specified. Thus, though the eroded size classes are generally clay and silt sizes, the average rate also includes the more rare impulses of sand-sized particles.

In terms of the mass continuity equation (Eq(3)), sand/clay/silt is partitioned to the sediment delivery component, thus leaving bedload to account for just the channel bedrock produced gravel, cobble and boulder.

Bedload rates for gravel and larger rock sizes are calculated using information and graphs found in Leopold and Emmett (1976). Figure 1. from this publication relates bedload (transport) rate to unit stream power ie. the higher the power/velocity/force/ momentum of streamflow, the greater the amount of coarse rock erosion and transport that will take place. This figure is reproduced on the following page.

The authors state that Figure 1. represents the relation of bedload transport to stream power for most rivers. Besides this justification for Tepee Butte application, the physics concept of equal transfer of momentum from one mass to another alone is ample proof of its usefullness. Unit stream power for use in Figure 1. = mass of water per unit volume x (flow) volume of water per second per unit of stream width x stream gradient in percent of unit downstream distance.

An adjustment of Figure VI.8 is needed before using the graph for calculating bedload transport rates for other streams. What the authors describe as "unit" stream power and its corresponding sediment transport rate is actually the amount of water and sediment that flows or is moved across a standard (unit) one-meter depth of streamflow. Thus the values used for unit stream power and the values obtained for bedload transport from Equation VI.8 must both be multiplied by the actual depth of a particular streamflow cross-section.

Quantifying unit stream power (and therefore bedload) was achieved with the aid of three additional products -- a method for determining flow volume, one for flow width and one for flow depth.

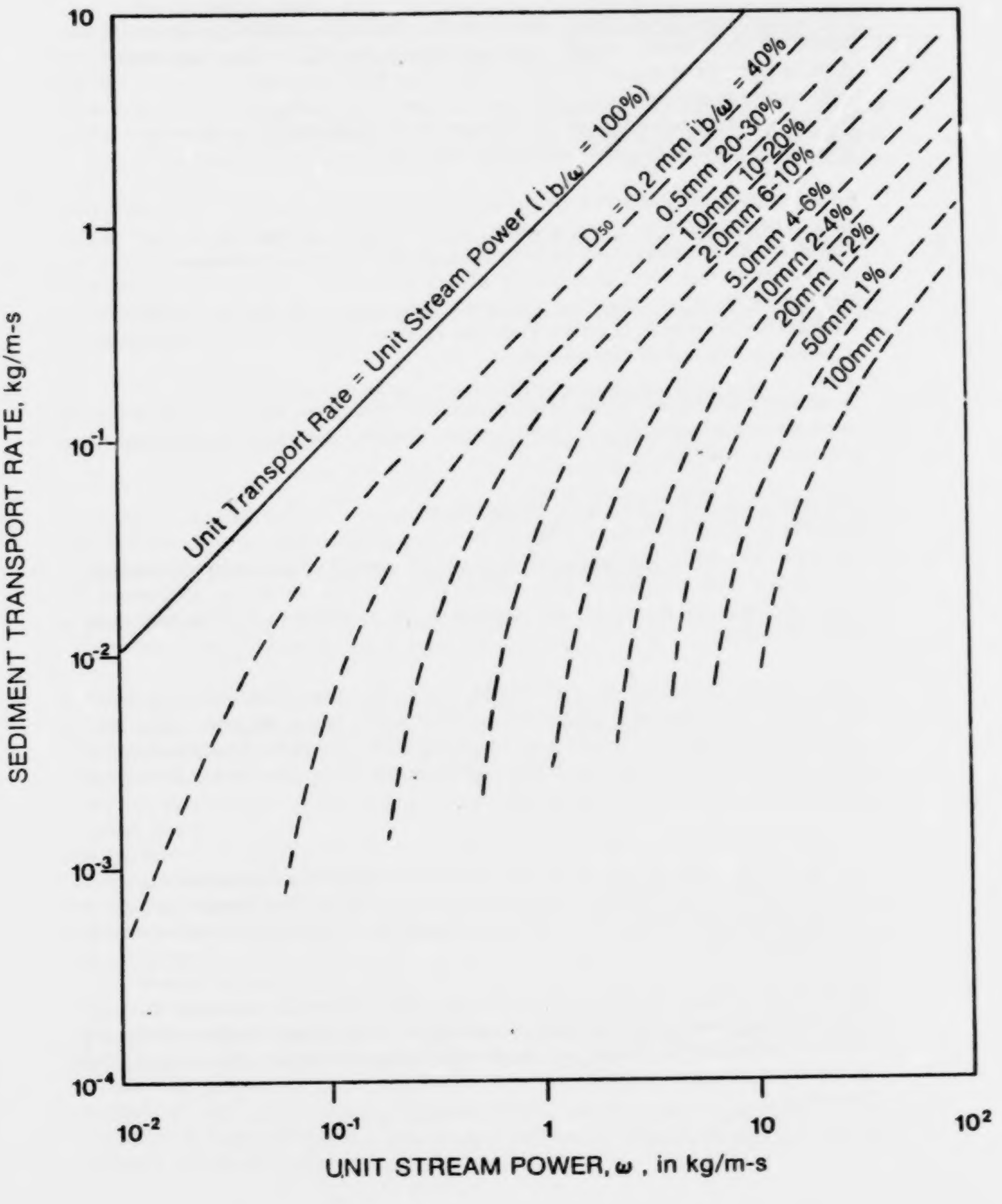
The flow volume of water was predicted for each month of the year using equations found in "Evaluation of the streamflow data program in Oregon" (Lystrom 1970). The equation-derived flow estimates for the months when there is enough stream power to produce bedload have a standard error of estimate of about 50 percent. To improve the accuracy of the flow estimates, the quantities were multiplied by a correction factor.

Flow quantity data exist for 1967 (Smith 1975). The correction factor equaled the measured June flow on Cottonwood Creek divided by the equation value for the same month (65 percent). 1967 was a typical runoff year for the Grande Ronde river basin (U. S. Geological Survey 1968) and thus should be close to the average year data obtained from the equation use.

Streamflow width is also needed in the stream power calculations. A correlation was developed between stream width and associated streamflow volume for Cook and Cherry Creeks. Flow and stream width data were obtained from Oregon Department of Fish and Wildlife 1976 field inventories. The correlation coefficient turned out to be an excellent 0.98.

Streamflow depths were calculated from the flow and width data with the aid of Manning's equation which determines stream velocity. A rectangular stream cross-section was assumed. Based on observations after the wildfire, this is appropriate since most of the streamcourses were observed to be degrading and well entrenched.

Figure VI.8 Relationship fo bedload transport and stream power for the East Fork River, Wyoming (reprinted from Leopold and Emmett 1976).



There is one adjustment needed before sediment yield produced by wildfire or management activities can be used to assess its effects at a point of interest downstream. Temporary channel storage of sediment above an analysis point must be accounted for. Some of the eroded soil that reaches a streamcourse will not be completely washed down until some time later. The desired analysis point is considered, in the above context, to be where it is desired to determine the sediment's effect on fish habitat.

A procedure (sediment routing) is given in U. S. Forest Service (1981, p. 22) that allows calculation of how much of the eroded soil delivered to a streamcourse is held-back. Figure 5 in the publication relates (a) the amount of soil yielded (complement of held-back) to (b) the watershed surface area in which the eroded soil was produced. The equation of the relationship is:

Eq(4)

$$\begin{array}{l}\text{Sediment volume reaching}\\ \text{desired analysis point (\%)}\end{array} = (\text{watershed square miles})^{-0.18}$$

The final equation for determining sediment yield is thus:

For short-term analysis of any Tepee Butte stream cross section or mouth of any watershed:

$$\text{Eq(5)} \quad \text{Sediment yield} = (\text{sediment delivery rate} + \text{bedload rate}) \times (\text{watershed square miles})^{-0.18}$$

This equation is not to be used for estimating the effects of sediments on fish habitat and production. The method used for this is a little different and is described starting in section F.

D. Surface Soil Erosion Modeling

The procedure used to model surface soil erosion is described in detail in Chapter IV of "An Approach to Water Resources Evaluation of Non-Point Silvicultural Sources - A Procedural Handbook" (US Forest Service 1980). This procedure uses the Modified Soil Loss Equation (MSLE) for quantifying soil loss on forested lands. It is the best model available at this time.

1. **Modified soil loss equation model** -- Estimates of surface soil losses resulting from silvicultural activities are based on soil, vegetation, and topographic features of the area(s) of concern. Areas modeled are the 72 subwatersheds of the Tepee Butte Recovery Project Area.

a. **Model description** --

MSLE MODEL: A = R,K,LS,VM

WHERE:
A = estimated average soil loss per unit area in tons per acre for the time period selected for R. It is not intended to reflect climatic extremes for a given year.
R = the rainfall factor, usually expressed in units of the rainfall erosivity index.
K = the soil erodibilty factor.
L = the slope length factor which is the ratio of soil loss from the field slope length.
S = slope gradient factor
VM = the vegetative management factor, which is the ratio of soil loss from land managed under specified conditions.

This procedure provides an estimate of surface soil erosion only and does not quantify erosion that may come from gullying or soil mass movement.

b. **Model Accuracy** -- The MSLE was selected because it provides a long-term estimate of the potential soil loss on a given site. It is an effective tool for comparing different management strategies and evaluating predicted response of a given watershed. Erosion values generated using this model are relative and will only be used for comparative purposes. However, since the data that drive the MSLE has either been collected or measured from topographic maps, results can be considered to be fair to good.

c. **Limitations** -- The MSLE predicts erosion based on expected future events. Sediment loads that could be generated in these watersheds are dependent on natural and management induced vegetative recovery periods and sequence and timing of storm events that may occur over the next several years. Actual amounts of sediment reaching functioning channels may be greater or less than those predicted by the model. These limitations do not, however, detract from its usefulness in displaying and comparing on and off site effects.

d. **Data Input** -- Soil erodibilty (K factor) and particle size estimates are based on soil survey data. The K factor is determined by the percent silt and fine sand fractions of the mineral soil, percent organic matter, and soil structure and permeability. Slope gradients, lengths, and shapes are determined from soil inventories and direct measurements from topographic maps. The maximum 30-minute storm intensity was determined using a 2-year return interval.

e. **Important Assumptions** -- The MSLE will reflect improved ground cover conditions over time. Following are some important assumptions used during application of the model:

-- Estimates of recovery for high-intensity burn areas:
    seeeded areas 3 years
    non-seeded areas 5 years
-- Pre-fire effective ground cover:
    timbered slopes - N,NE,NW aspects - 95 percent
    timbered slopes - S,SE,SW aspects - 85 percent
-- Pre-fire effective ground cover:

grasslands - N,NE,NW aspects, greater than 30 percent slopes - 80 percent
grasslands - ridgetops, plateaus - 85 percent

-- Post-fire effective ground cover, timbered areas:
high intensity burn areas: 80 percent bare soil
20 percent effective ground cover
No canopy cover
moderate-intensity burns: 40-60 percent bare soil
55 percent canopy cover, north slope
55 percent canopy cover, south slopes
low-intensity burn areas: Little change in surface soil characteristics. No increase in surface soil erosion potential

-- Post-fire effective ground cover, grassland areas:
high-intensity burn areas, slopes greater than 30 percent:
80 percent bare soil
high-intensity burn areas, slopes less than 30 percent:
60 percent bare soil
moderate-intensity burns - 60-70 percent bare soil
low-intensity burn areas - No change in effective ground cover

2. **Gully development** -- The decision to model only for surface erosion was based on the need to identify the most likely sequence of post-fire events. Gully erosion is caused by concentrated or intermittent water flow that may result following heavy rains or concentrated snow melt runoff. Gully development and subsequent erosion depend on localized events which are difficult to predict. Estimates of soil loss can only be made once gully development has begun.

3. **Soil mass movement** -- Natural, large scale soil mass movements, rock slides, and earth flows are a rare occurrence within the project area. Those areas that have failed and those that exhibit unstable characteristics are associated with the complex geologies of steep, non-forested canyonlands adjacent to the Snake River. Small scale failures have occurred in areas adjacent to the analysis area as a result of road building and small localized failures within the project area. However, the potential for this happening is low and will be dealt with through cutting-unit and road location decisions and appropriate mitigation measures. Soil mass movements will not be modeled in this analysis.

E. Sediment Delivery To A Streamchannel

Eroded soil does not become sediment unless it is delivered to a functioning streamchannel. On a short-term (few 10s of years) basis, generally only a small percentage of the total soil moved by surface erosion becomes sediment. Estimating sediment delivery involves assessment of the following factors:

- Water availability for surface runoff.
- Texture of eroded soil material. Fine-textured soil materials erode more rapidly.
- Effective ground cover - This reduces energy of runoff and protects soil surface from raindrop impacts.
- Slope shape C concave slopes promote deposition, while convex slopes increase carrying capacity.
- Slope gradient - Increasing gradients increase available energy for sediment delivery.
- Delivery distance - Increasing the distance to a functioning streamchannel generally decreases the amount of delivered sediment.

- Surface roughness - Rougher surfaces tend to dissipate energy of surface runoff and cause deposition.
- Site specific factors such as fire-induced non-wettability or micro-relief adjacent to streams may concentrate or retard flows.

All the above factors are incorporated into a sediment delivery index model which is used to determine the proportion of on-site surface erosion that reaches a functioning channel. The use and limitations of this model are described in "An Approach to Water Resources Evaluation - Non-Point Silvicultural Sources (US Forest Service 1980).

F. Natural/Pristine Sediment Yield

For procedures needed later (sections G. and H.) for determining sediment effects on fish habitat and fish numbers, a determination of natural/pristine sediment yield is needed. Equation (5) from section C. can be simplified to meet this need.

The natural/pristine sediment yield is the average long-term yield that occurs over many 100s or even 1000s of years. Equation (5) was developed and is applicable for analysis periods of a few 10s of years. For this short-term period, temporary sediment storage in channels must be considered. Over long-term 100s of years, this storage/detainment component can be eliminated. Detainment is inconsequential.

From the above, for long-term analysis of any Tepee Butte stream cross section:

Eq(6) Natural sediment yield = sediment delivery rate
+ bedload rate

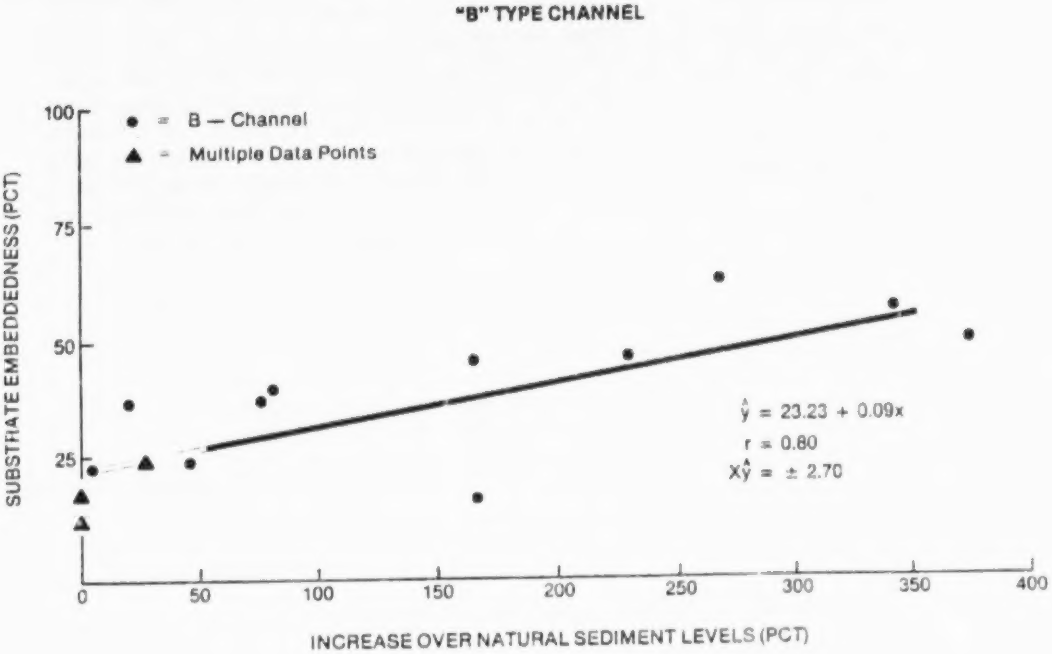
G. Adapting Natural Sediment Yield For Use In Predicting Effects On Fish Habitat And Fish Numbers

The natural (pristine) sediment yield is needed for use in equations/graphs that relate sediment volume deposited on a streambed to fish habitat and fish numbers. These equations are found in "Guide for Predicting Salmonid Response to Sediment Yields in Idaho Batholith Watersheds" (U. S. Forest Service 1983.)

An example of one of the curves is shown in Figure D-2. The y-axis intercept of the linear curves gives the embededness or fines by depth expected for a natural sediment yield in granitic watersheds where the relations were developed. For the Tepee Butte watersheds which are non-granitic, the y-axis intercept value for mostly timbered subwatersheds should have a lesser value (p. 20, US Forest Service 1983). For mostly grassland subwatersheds, the value will likely be greater. The y-intercept value should be proportional to:

$$\text{Eq(7)} \quad \frac{\text{Natural sediment yield for Tepee watersheds}}{\text{Natural sediment yield for granitic watersheds}} = \text{proportionality factor}$$

Figure D-2 Channel substrate embeddedness-sediment response curve for "B" channels from Clearwater and Nez Perce National Forests' data (reprinted from U.S.D.A. Forest Service 1983).



The procedure for deriving the new Y-intercept values is somewhat complex and is discussed in detail in Watershed Environmental Effects Analysis Process Paper, which is on file in the Tepee Butte project files and is available on request.

H. Determining The Increase In Sediment Yield Over Natural Yield For Fish Predictions

The Figure D-2 family of curves requires as an input the "increase over natural sediment levels". By this the authors (US Forest Service 1983, p. 53) mean the increased sediment yields relative to the natural sediment yield as provided by using procedures given in US Forest Service 1981. In this publication, this increased sediment yield (p. 25) is defined as sediment from management-induced surface erosion plus sediment from management-induced mass erosion. For the Tepee Butte area, the term "management-induced" conceptually/operationally also includes "wildfire-induced". Surface erosion for Tepee Butte watersheds is given the name "sediment delivery", and Tepee Butte watersheds have insignificant past or future mass soil movement probability. Therefore, for use on Tepee Butte analysis areas:

Eq(8) Increase over natural sediment levels (%) =

$$\left[\frac{\text{sediment delivery}}{\text{natural sediment yield (Eq(6))}}\right] \times 100$$

Again an adjustment must be made for sediment detainment by channel storage, and Equation (4) is again used.

Equation (8) thus becomes, for each desired fish analysis point:

Eq(9) Increase over natural sediment levels (%) =

$$\left[\frac{\text{sediment delivery}}{\text{natural sediment yield (Eq(6))}}\right] \times 100 \times (\text{watershed square miles})^{-0.18}$$

VI. LONG-TERM SITE PRODUCTIVITY

Modeling for long-term site productivity is a complex and not well understood undertaking. Productivity of forest soils depends on physical soil conditions, climatic and biological factors. Soil conditions, micro-climate, and biological factors can be drastically altered as a result of wildfire or other management activities.

The loss of nitrogen is of particular concern on forested soils of this area. Potential for nitrogen loss (volatilization) due to combustion of litter and organic matter can be translated into potential losses of long-term productivity. These potential losses have been noted (Klock and Grier 1981, Tiedemann 1981, Harvey et al. 1987b, 1988a). A large percentage of the total soil nitrogen is stored in the surface soil layers; and because of the microbial activity in these layers, which is associated with nitrogen input, concern over the potential cumulative impacts on these soil layers is warranted.

The scope of these potential changes will depend on the type of impacts and the cumulative nature of those impacts.

A. Fire-Induced Changes

Wildfire can result in a reduction in site productivity as a result of soil erosion, nutrient loss and interruption of nutrient cycles, reduction in water holding capacities and microorganism populations, and micro-site modifications.

The degree and extent of these changes is governed to a large degree by the intensity and duration of the fire.

1. **High intensity burn areas** -- Areas where the overstory is destroyed and the surface litter and organic matter is completely consumed have the greatest potential for reducing long-term site productivity. High intensity burns result in a loss of 70 percent or more of the surface litter and duff and as a result 50-75 percent of the total nitrogen on that site may be lost through volatilization of this material (Boyer and Dell 1980). Burning in most high-intensity areas was of short duration. In most cases the duration was for 1/2 hour or less. This short duration resulted in less destruction of organic matter within soil layers. In addition, soil hydrophobic conditions (non-wettability) are only likely to have developed in coarse textured soils with heavy residue accumulations. The more significant aspect of this organic matter reduction is the increase in exposed soil areas which could result in increased erosion, additional loss of nutrients and a reduction in water holding capacity of the site.

   The actual effects on long-term site productivity in high-intensity burn areas will depend on site-specific fire intensities and erosion losses. Harsh sites, those with limited productivity potentials, would be affected to the greatest extent.

2. **Moderate intensity burn areas** -- Areas experiencing moderate burn intensities may have lost up to 50% of the surface litter and duff with little alteration of subsurface organic materials. Moderate burn areas may have lost up to 50% of the total nitrogen available in surface organic material. This loss is occurs through the volatilization of organic matter. Surface cover losses range from 40-70% for a given area. In moderate burn areas some gains in available soil nutrients may be realized as a result of the fire.

   Under moderate burn intensities a mosaic of burned and unburned conditions is created and thus potential erosion is reduced over that of high intensity burn areas.

   The potential for long term productivity losses in moderate intensity burn areas is dependant on the extent of surface residue, soil litter and duff consumption and the amount of exposed soil subject to erosion. The potential to effectively manage productivity through on-site mitigation and residue management is good and long term productivity losses would be minimized.

3. **Low intensity burn areas** -- Little modification of surface organic matter and duff occurred in low intensity burn areas. Erosion potentials were not increased and long term soil productivity potentials were not affected. Some gains in available nutrients would occur in these areas due to release of nutrients in the ash.

B. Potential Harvest-Induced Changes

Harvest induced changes as related to potential long term productivity effects include: reduction in water infiltration due to soil compaction, loss of surface layers and soil organic matter due to soil displacement and nutrient losses due to residue removal. These cumulative effects may result in placing surviving forest stands under severe stress and thus more susceptible to disease and insect attacks. These harvest induced effects can be mitigated through implementation of Best Management Practices.

C. Summary

Site productivity in inland northwest forests is, for the most part, governed by available soil moisture, nutrient supply and temperature (Daubenmire and Daubenmire 1968, Hall 1973). This is true of the lodgepole pine, ponderosa pine and mixed conifer forests. The key for maintaining long term site productivity in these forests is to minimize displacement, conserve or enhance organic matter, minimize soil structural changes and minimize soil erosion.

The post fire condition of the analysis area has severely limited our options with respect to on site residue and soil organic matter management. The key to minimize long term productivity reductions in burn areas is to minimize erosion and to leave an acceptable level of slash and other residue on-site to act as a nutrient reservoir and microbiological habitat.

Modeling the various soil, biological and climatic interrelationships in an attempt at predicting long-term productivity changes is difficult, impractical and unreliable. Given this, the approach will be to analyze harvest alternatives with respect to: cutting-unit, road, and logging system designs; residue management; and erosion control activities of both mitigation and rehabilitation. All alternatives must meet Regional standards with respect to maintenance of long-term site productivity.

Specific limitations include: (1) soil disturbance criteria to minimize soil structural changes and erosion, and (2) residue management to maintain a nutrient reservoir on-site with recommended levels ranging from 15 to 20 tons/acre of 3-9 inch material.

VII. TURBIDITY IN FOREST STREAMS

There are no additional comments pertaining to turbidity. The subject is explained in Chapter IV, Environmental Consequences, Water Resources.

VIII. RAINFALL-INDUCED PEAK STREAMFLOW

A rainfall peakflow prediction model could not be found that would accurately describe (mathematically) the total effects of wildfire on such a large area, especially one that could be used with fine adjustments for management project soil impacts. However, a research study is available for assessing concentrated runoff inputs to immediately adjacent streamcourses and will be used in this analysis.

Chapter IV, Environmental Consequences, **Rain-generated Peakflow** discusses the rationale for using Best Management Practices (BMPs) which were developed from the research study as a surrogate for a "whole watershed" peakflow prediction model. The research publication used is: Packer (1964). This publication was developed from field data obtained just across the Snake River in Idaho. The ecosystem, soils and climate there are very similar to those conditions within the Tepee Butte analysis area.

Following is a condensed version of how the BMPs were developed. For a full description see the Watershed Environmental Effects Analysis Process Paper which is on file in the Tepee project files and is available on request. Also see Appendix D, Best Management Practices for a more thorough description of BMPs that are referred to below.

In order to decide which BMPs to design, the site factors that could affect rain peakflows were outlined. This procedure isolated the situations that would require BMP control as well as the vigor of that control. These BMPs were then tested to see if they also met the objectives for minimizing soil loss and the even tighter criteria for minimizing movement of that soil to streamcourses. Essentially, the result was a decision key that could be used for the design of various activities and EIS Alternatives.

The organization of the discussion that follows is:

1. **Yarding Methods**
    - a. **Runoff concentration on a skidtrail or dragtrail**
        - **(1) Ground based skidding, one-end suspension and no-suspension yarding**
        - **(2) Full-suspension skyline yarding**
        - **(3) Helicopter yarding**
    - b. **Runoff concentration on log landings**
    - c. **Infiltration rate change (soil compaction, disruption of duff/litter, soil depth loss thru erosion or mechanical displacement)**
        - **(1) Full-suspension skyline and helicopter yarding**
        - **(2) One-end suspension skyline and cable no-suspension yarding**
        - **(3) Ground based yarding**
2. **Truck Road Construction, Use And Maintenance Adjacent To Streamcourses**
3. **Fuel Management And Site Preparation Methods**

All of the discussion is relative to the site conditions that exist After Fire With No Management Projects.

1. Yarding Methods

a. **Runoff concentration on a skidtrail or dragtrail** -- For the purposes of this section, this process is defined and characterized as:

    - Runoff is surface water produced by rainfall on bare soil (not snow covered).

    - Concentrated runoff is runoff collected in an eroded sidehill channel (not a Class I thru IV streamcourse) that is one inch or more deep at its downhill point.

    - A skidtrail is a place where ground based yarding has caused bare soil exposure due to the combined effect of both equipment and log skidding.

- A dragtrail is a place where a log being pulled on the end of a cable has been the only influence in causing bare soil exposure.

    - A primary dragtrail is a dragtrail that exists in conjunction with all yarding methods except helicopter, full-suspension skyline and ground based skidding. It occurs in-line with the main cable that leads uphill to the yarder, and almost always has multiple log dragging events repeatedly occurring on the single dragtrail location.

    - A secondary dragtrail is a dragtrail produced by the mostly side yarding that occurs as logs are pulled either (a) to a carriage which is located on the main cable or (b) to the end of a ground based skidding vehicle. Secondary dragtrails seldom produce eroded sidehill channels that approach a depth of one inch. This is because they generally are the result of single, not repeated log-drags, and are mostly across slope which thus usually provides for outsloping that rapidly/constantly removes any runoff before it can become concentrated.

    - Concentrated runoff on a skidtrail or primary dragtrail is runoff that is produced on the trail *or* is intercepted from adjacent hillside, *and* is concentrated as the flow moves downslope on the trail.

Runoff concentration on skidtrails/dragtrails is the most important determinant of rain peakflow responses associated with yarding methods.

(1) **Ground based skidding, one-end suspension and no-suspension yarding** -- To prevent runoff concentrations from reaching a streamcourse and becoming a peakflow increase, the skidtrails and primary dragtrails must be terminated (not produced) some distance before a streamcourse is reached. Water runoff produced on the trails must be allowed enough distance to be absorbed into the soil, thus preventing its stream entry. The Packer publication provides a method for determining at what distance a skidtrail or primary dragtrail should be terminated. Table 3 in the publication first lists the type and spacing of obstructions below an area of concentrated trail or road runoff.

Obstructions are what impede the concentrated trail runoff and help give it time to move into soil, whereby it then is slowed enough to not be a factor in increasing rain peakflows. This is relative to site conditions which exist before trails are installed. The type of obstruction conditions modeled were those that will be in effect during 1989, when the bulk of non-winter logging will occur. Obstruction conditions this first season after the fire are thus poor (they will progressively get better in future years as erosion control seeding takes complete hold and dead trees fall). The obstruction evaluation assumed, that except for the upper surface evaporation layer, that soils will be saturated with water.

This is so because during the first summer after the fire, mostly shallow rooted biennial wheat will be invading the sites and almost all shade will have been removed by the fire.

After an initial distance value was obtained for obstruction type and spacing, other factors were used to further adjust this value. These factors involve soil type, distance to the first obstruction that is encountered, distance between trail crossdrains (waterbars), and the desired assurance for no concentrated runoff reaching a streamcourse.

A 97 percent assurance level was chosen to provide "no reasonable doubt" of BMP effectiveness. It is expected that 97 percent of the runoff producing rainstorms will not produce enough surface runoff to reach a streamcourse. To reduce this low expectation even further an additional adjustment was made that is not in Packer's procedure. The increased runoff that would be produced by a 50-year recurrence interval rainstorm was calculated to be 40 percent more than that produced by a 10-year storm. The buffer distances below skidtrails and primary dragtrails was increased by this same 40 percent in order to account for the 40 percent increase in runoff.

BMP 1A, found in Appendix D, is the resulting BMP that specifies buffer distances within which skidtrails and primary dragtrails are not allowed.

Further notes:

- The Packer model addresses to the prevention of eroded soil from reaching a streamcourse after moving into a buffer and does not directly address surface runoff. However, the soil movement Packer refers to is carried by surface runoff. It won't get to the stream if it is not carried by runoff. The way to stop the eroded soil is to stop the surface runoff. To do so, Packer calls for a buffer that is wide enough to allow the water to pass into the ground before it reaches the stream course. Therefore for use here, 'no water to streamcourse' and 'no eroded soil to the streamcourse' are synonymous concepts.

- This BMP buffer, derived for rain-produced peakflow prevention, will also apply to preventing runoff concentration on trails during periods when just snowmelt runoff is being generated. This is easily so, since a buffer designed for snowmelt would be narrower because of snowmelt rates that are far lower than runoff rates that would be produced by a 50-year high-intensity rain.

Four additional BMPs that were chosen primarily for reducing soil erosion also apply here in further preventing runoff concentration on skidtrails and dragtrails. These BMPs are 3F, 4A, 4B and 4L.

(2) **Full-suspension skyline yarding** -- Log lift-off dragtrails are very narrow (about one log width) and almost always 5 feet or less in length. The EPA-endorsed WRENSS document (page II.10) (US Forest Service 1980) does not categorize this yarding method as producing dragtrails that are long enough to produce runoff concentration. Even so, there is a skyline situation where log lift-off occurs after a short drag downhill. This situation could result in concentrated runoff producing channels greater than one inch deep. The down-slope lift-off skidding situation will occur when the skyline tail-hold tree is on one side of a

streamcourse and the landing is higher on the other side of the stream. The log lift-off dragtrails will tend to funnel towards each other and congregate at a single final downslope point. One inch of concentrated dragtrail runoff could occur. The buffer width associated with BMP 1A can be used for this situation. BMP 1B provides this direction.

(3) **Helicopter yarding** -- Log lift-off dragtrails are very narrow (about one log width) and almost always 5 feet or less in length. The EPA-endorsed WRENSS document (page II.10) (US Forest Service 1980) does not categorize this yarding method as producing dragtrails that are long enough to produce runoff concentration. Therefore there is no effect on rain peakflow and no BMP is needed.

b. **Runoff concentration on log landings** -- Log landings can be large areas of bare soil. There is great opportunity for concentrating runoff into sidehill channels that are greater than one inch deep. Often the landing is below a series of skidtrails or primary dragtrails that bring logs to the landing. The information developed for BMP 1A is used again to derive a buffer width to apply to log landing location. To compensate for a greater chance of producing concentrated runoff, the widest buffer width derived in the 1A process (300 feet) was used.

c. **Infiltration rate change** -- Infiltration is the movement of rain or snowmelt water into the soil. If it is within the soil it can not be concentrated runoff. Three additional site factors that can be affected by yarding methods and can result in infiltration rate reductions and, in turn, concentrated runoff with possible rain peakflow changes are:

- soil compaction
- disruption of duff and litter
- soil depth loss through erosion or mechanical displacement

(1) **Full-suspension skyline and helicopter yarding** --
(2) **One-end suspension skyline and cable no-suspension yarding** --
(3) **Ground based yarding** --

With the use of these three methods, disruption of duff and litter will not be a factor since the fire, in the dead and soon to be dead tree salvage areas, has already destroyed the duff and litter layer. Significant soil compaction will only occur on ground based systems' skidtrails (BMP's 5B, 5C, 5D and 5H are used to eliminate significant compaction outside of skidtrails). Soil depth loss thru erosion or mechanical displacement will occur on skidtrails. BMP 1A will already have been applied and the consequent increased concentrated runoff from the loss of infiltration capacity due to compaction and soil loss will be prevented from entering a streamcourse.

2. Truck Road Construction, Use And Maintenance Adjacent To Streamcourses

The key to preventing road runoff from contributing to rain caused peakflows or from snowmelt caused peakflows is actually simple. Road surface crossdrains can be constructed close enough to allow runoff collected by them to be directed into places where water will be absorbed or stored before it can contribute to peak streamflow. BMPs will be selected to accomplish good road surface drainage.

Packer provides an accurate and reliable method for accomplishing this. His approach is two-fold:

- Design road surface drainage spacing such that road surface water is taken off the road often enough to provide for low volumes of runoff between drains and to prevent the formation of runoff ruts more than one inch deep.
- Provide for placement of the runoff collected by each crossdrain into an area that is suitable for absorbing the runoff before a streamcourse is sectioned. BMP 1G presents one option though, that instead stores the road runoff in the channel itself.

The discussion and BMPs below apply specifically to controlling rain runoff that occurs when snow is off the area. Although when these BMPs have been implemented on a road, this will also provide the basis for controlling snowmelt peakflow increases associated with road runoff.

a. **Road surface crossdrain spacing** -- BMP 1D is designed for use in specifying the distance between surface crossdrains to be installed on roads. This BMP uses Packer's Table 2 with two modifications. The soil (parent material) group that applies where Tepee Butte roads will be built is in Group 2 (basalt). This was used for the Native Material line in BMP 1D. Soil Group 1 was used for the next pit-run line, to account for the less erodible surface containing more rock. The surface crossdrain spacing shown in his Table 2 was reduced 20 percent to account for greater concentrated runoff produced by a 50 year recurrence interval rainstorm. 20 percent is one-half the adjustment factor developed for use in BMP 1A. The other half (also 20 percent) was applied as an increase in the width of the buffer corridor below a road needed to absorb concentrated road runoff (see BMP 1F below).

   Installing road surface crossdrains according to the BMP spacing guide is expected to produce 1.2 inch (20 percent more than 1 inch) of concentrated runoff on the road surface during a 50 year rainstorm and much less runoff depth during less intense rainstorms. Dealing with the 50 year known 1.2 inch volume allows for the later exact calibration of the buffer corridor needed below a surface crossdrain.

b. **Waterbar installation during road construction when rain is forecast** -- BMP 1E specifies that when the road construction is not completed and when the road is within 300 slope distance feet of a streamcourse, waterbar installation shall be required prior to approved permanent drainage features when a 50 percent chance (or greater) rainfall is forecast, and during periods of inactivity lasting more than 10 hours.

c. **Buffer corridors for concentrated road runoff** -- BMP 1F is for determining the length of the buffer corridor needed to prevent 1.2 inches of concentrated runoff exiting from a road surface crossdrain from reaching a streamcourse. Again, Packer's Table 3 was used as the basis for this determination. 97 percent assurance was again used.

   The buffer corridor width resulting after the above steps (139 feet) was then increased 20 percent to account for increased concentrated runoff (1.2 inches) being produced below surface crossdrains as the result of a 50 year recurrence interval rainstorm. 20 percent is half of the adjustment factor derived in conjunction with BMP 1A, the other half was assigned to BMP 1D. The final buffer corridor distance derived from above was 165 feet.

   Further adjustments to the 165 feet value are shown in BMP 1F. The rationale is that if concentrated road runoff being emitted by crossdrains or a flow splitter is reduced from the 1.2 inches associated with the 165 foot initial value, then there is a directly proportional reduction in the buffer corridor distance needed to absorb this reduced volume of road runoff. if ther is less water, less widthis needed.

d. **Prevention of concentrated road runoff from causing peakflow increases when buffer corridor is too narrow** -- BMP 1G prescribes storing or dissipating crossdrain runoff when buffer corridors are too short to completely absorb runoff.

One option specified as permissible by the BMP needs further discussion.

- In first-order, Class IV streamcourses only, construct a runoff retention basin within the streamcourse immediately below a crossing culvert. Collect and direct road runoff to this retention basin. Collect all running surface runoff produced between the last crossdrain that had an adequate buffer corridor and the crossing point. Direct runoff to the retention basin with the use of inside ditches and/or berms. Design volume of the basin as described in first technique. The basin must have significant rock to prevent wash-out, or be constructed with a log(s) that is keyed into the bank and is lined with impervious cloth. Basin should not be removed when road is closed unless it is judged to have become unstable.

The rationale for this technique follows:

- First-order streamcourses will be dry before high intensity rainfall events. They almost always flow only in response to snowmelt runoff, and then generally don't flow enough volume to erode an obvious rocky bottom channel. They are very small, ephemeral streamcourses.

- Therefore, the dry retention basins will fill first with the rapidly produced road runoff, thus eliminating road runoff as a contributor to any later developed peakflows that may develop off of hillside areas.

- Channel disruption from road crossing itself is already a given; the additional disruption required in producing the retention basin will only be a few feet more, and will be tolerable relative to the overriding benefit to catching/storing concentrated road runoff.

- Retention basin will also catch and reduce overall sediment movement, both from off the road and from off above fire-damaged land.

- All constructed new roads will be closed and restored after project use. Therefore, the longest the retention basins need to function is one or, at the most, two years. After this, very close waterbars on the road will not produce any concentrated runoff that could cause peakflow increases, even if retention basin did not exist.

3. Fuel Management And Site Preparation Methods

All fuel management and site preparation activities will be directed by the BMPs specified in the previous sections.

IX. SNOWMELT-INDUCED PEAK STREAMFLOW

The model used for estimating snowmelt and snowmelt plus rainfall streamflow, is described in "An Approach to Water Resources Evaluation of Non-Point Silvicultural Sources of Pollution" (U.S. Forest Service 1980). As described below, the model is applied differently, depending upon the period being analyzed. The modeling process is broken down into each of the environmental analysis time periods: Pre-fire, Post-fire with no recovery projects (10-year period), and Post-fire with recovery projects (10-year period).

Loss of forest cover due to the fire will result in higher peakflows. The loss of tree canopy will reduce the amount of rain and snow intercepted, reduce the amount of soil moisture evaporated and transpired, and reduce the shading of snowpacks. Increased snow will accumulate in the new openings, melting off more rapidly in the spring as compared to snow under the previous canopy. Snowmelt runoff will have greater volume and occur earlier in the year than during pre-fire conditions. The magnitude of the high flows which actually occur will be modified somewhat by the depth of the snowpack, air temperature, wind speed and direction, and amount of rainfall on snow in the spring.

For the project area, change in snowmelt generated peakflows are generally of more significance in determining stability of streamcourses than are rainfall generated peakflows. This is because snowmelt peakflow behavior will not return to pre-fire conditions until trees fully occupy sites (more than 30 years). Rainfall generated peakflows will be substantially reduced as soon as lost ground cover of herbaceous vegetation is fully reestablished, or about 3 to 5 years after the fire (much of fire area was reseeded to herbaceous species, and the rest of area is expected to have vigorous regeneration from non-killed grass and shrub roots).

Pre- and Post-Fire With No Recovery Projects (10-year period)

For these analysis periods, a simplified and computerized version of the model was used, the same one that has been used to estimate snowmelt peakflows for about three years on the Wallowa-Whitman National Forest. The project area was divided into 72 subwatersheds, any one or combination of which could be analyzed for an estimate of snowmelt generated peakflows. Data elements (information inputs) used to operate the model are:

- Aspect as an expression of a high, intermediate or low solar energy exposure (essentially northerly, southerly or east-west)
- Live tree basal area (density) as an index to snow shading, soil moisture utilization and precipitation interception losses. (Past basal area reductions were accounted for if the trees were not fire-killed.)
- Plant ecological type used to index maximum basal area that can exist in a pristine tree stand
- Mean monthly precipitation
- Maximum distance that dry snow can blow over non-tree areas before being deposited on ground

- Tables that relate tree basal area for particular tree ecological types to a stage along the continuum to full basal area occupancy (full hydrologic recovery)

The output used for peakflow analysis is inches of simulated streamflow for the highest 6-day flow period (the model also generates streamflow for lower/all 6-day periods throughout the year -- the complete yearly hydrograph). The model does not generate instantaneous peak streamflow. An assumption is made that if the Post-fire highest 6-day flow is increased by a certain percent, that the instantaneous peak will be raised by a commensurate amount.

Some assumptions/simplifications were made for certain program data parameters. These were made to expedite the analysis without significantly impairing the quality of the peakflow model estimates. Furthermore, these simplifications were judged acceptable because a comparison is being made of pre- and post-fire with no recovery projects. An analysis is not being made of the possible additional effects of action Alternatives (G, H, I and J). Deviation from a prediction of the "true" peakflow quantity does not have any relevance/consequence for assessing significance of an action Alternative's effects.

The assumptions/simplifications made for the computer model parameters are:

- Tree dominated ecotypes were assigned to one of five possible major classes instead of about 15 more explicit ones.

- Basal area values were assigned to seven classes rather than having the model operate on exact basal area values.

- Mean monthly precipitation was raised to a higher value than reality, in order to get a peakflow estimate based on a more critical extreme snowpack year. Higher peakflow estimates result.

- Maximum distance of blowing snow was constrained to a maximum distance of 1100 feet, which is a typical distance between ridge and streamcourse bottoms in the upper middle of the subwatersheds. These geomorphic features have become the major determinant of blowing snow distance since the ordinary determinants, fully canopied trees, have been destroyed by fire.

Post-Fire With Recovery Projects (10-year period)

The modeling process for this category had been dependent on whether live trees were to be removed by any of the action Alternatives (G, H, I and J). As it turned-out, only dead or soon to be dead trees will be removed (no live trees).

1. If only dead or soon to be dead trees are salvaged/removed, snowmelt induced peakflows will be the same as for the post-fire with no management activities analysis period.

   Snowmelt peakflows following implementation of action Alternatives will be the same as those produced by the No Action Alternative. If dead trees are left standing, allowed to fall, or removed by salvage, the peakflow during the analysis period will be the same.

   This statement on salvage activity effect is further substantiated by additional rationale:

- The small amount of shade that will exist for a few years until trees fall over will be offset by the effect of black tree boles (stems) producing high amounts of back-radiated heat energy from sunlight. Lower snowmelt rates due to shade are expected to be offset by higher snowmelt rates due to heat radiation.

- Concentrated runoff from roads, skidtrails and primary dragtrails is prevented from significantly building-up. It is either caught and stored, or it is forced to pass through a buffer area where the small runoff build-up is dissipated before it can reach a streamcourse. Both actions prevent the runoff from contributing to peakflow increases relative to the No Action Alternative. BMP's 1A through 1G described in Appendix D provide this protection.

- Almost all soil areas compacted by salvage activities are associated with these same roads, skidtrails and primary dragtrails. The reduction in water infiltrating capacity into the soil due to compaction is considered in the design of the BMPs. Again, there is no additional peakflow contribution here. There are no other areas of significant compaction to act as peakflow source areas, except for log landing areas which are substantially buffered by a 300 foot strip adjacent to any streamcourse (BMP 1C).

To affirm the validity of these assumptions, monitoring will occur. For assessing equality of snowmelt rates, side-by-side study plots will be set-up on various sunlight exposures (aspects), one of a pair will be in a salvaged tree stand and the other in a non-salvaged stand. Snow depth measurements will be taken during spring snowmelt periods to test whether the rate of depth decrease (snowmelt) is the same or different. BMP's 1A through 1G are monitored as described in the Best Management Practices Appendix D.

2. The harvesting of live trees would require analysis with the WET hydrological model. The WET model is another computerized rendition of the model used for estimating pre- and post-fire peakflows. It does not incorporated any of the simplifications previously discussed.

X. NUTRIENTS IN STREAMS

The flux of nutrients in a stream ecosystem in an undisturbed forest are in balance. Phosphorous and nitrogen are the two nutrients typically of concern in a disturbed system because most streams are limited in these nutrients. An increased nutrient supply can cause microorganisms to expand in numbers and utilize and thus remove dissolved oxygen needed by amphibians and fish. Algae blooms (increases) can also occur to the detriment of stream esthetics. There are no known models available to predict the total nutrient addition to stream water by silvicultural activities, particularly following wildfire.

Large amounts of nitrogen in the vegetation were vaporized and lost as gas from the forest system during the fire. The remaining available nitrogen will either be taken up by vegetation or flushed through the soils and into the streams. Elevated concentrations of nitrates in the streams would probably be measurable for the first two or three years until the vegetation on the watersheds recolonizes the soil profile. Based on research studies around the Pacific Northwest, the nitrate and phosphate concentrations in the stream water will not exceed drinking water standards or cause eutrophication of streams within or below the project area.

The insoluble component of nitrogen and phosphorous lost from the system is directly proportional to sediment loading from surface erosion. By definition (is insoluble), this component can have no effect on water quality. Changes in the amount of sediment entering stream systems under various Alternatives was evaluated and is discussed in Section V. of this appendix.

XI. EFFECTS ON FISH

Fish habitat analysis is based on the US Fish and Wildlife Service Habitat Suitability Index, described in Raleigh et al. (1984). This procedure includes 18 possible variables used to assess rainbow trout habitat capability. It assumes that the freshwater habitat requirements for steelhead are essentially the same as rainbow trout except for (1) water temperature requirements in spring for smoltification; and (2) temperature and flow conditions for upstream migration of adults.

The model uses a modified limiting factor procedure. This procedure assumes that model variables and components with suitability indices in the average to good range (greater than 0.4 but less than 1.0) can be compensated for by other related model variables and components with higher suitability indices. However, suitability indices less than 0.4 cannot be compensated for. Variables correspond to the following water quality and riparian zone parameters that affect fish habitat quality:

- Water temperature changes: Expected changes due to the fire are increased summer and decreased winter temperature, and increased icing due to loss of riparian vegetation. Expected changes due to the action alternatives are decreased temperatures due to increases in riparian vegetation, especially shrubs and trees.

- Changes in dissolved oxygen (DO): Increases in summer water temperature will result in corresponding decreases in DO.

- Changes in percent fines in channel substrate: Increased sediment deposition is expected due to effects of fire. Additional effects could result from recovery activities.

- Changes in allocthonus input: This is expected to decrease immediately following the fire due to loss of riparian vegetation, especially hardwoods and grasses. Increased inputs will occur as riparian vegetation recovers.

- Changes in amounts of in-stream, large woody debris (LWD): An increase in LWD is expected due to blow down of fire-killed trees.

- Changes in stream flow patterns: Increased peak flows are expected as a result of the fire. Summer lowflows could also change. Cumulative effects could result from recovery activities.

These variables are discussed in greater detail next:

Average Maximum Water Temperature During The Warmest Period Of The Year.

Pre-fire water quality, including temperature, was good to excellent in all three streams within the project area. Significant changes in water temperature are expected as a result of the fire. A large amount of shade was lost when the fire burned and/or killed riparian vegetation. The largest single factor affecting maximum stream temperature is direct solar radiation. Therefore, maximum water temperature is directly related to the amount of stream shading. Timber harvest in riparian areas could add to this effect. Measures to accelerate recovery of woody riparian vegetation would help restore stream temperatures to pre-fire levels.

Average Minimum Dissolved Oxygen During The Late Growing Season, Low Water Period And Embryo Development

Due to the relatively steep stream gradients rapid aeration, dissolved oxygen levels are expected to remain near saturation. However because of expected increases in summer water temperatures, there may be a corresponding decrease in DO levels.

Percent Substrate Size Class (10-40 cm) Used For Winter And Escape Cover By Fry And Small Juveniles

Substrate of this size range has large enough intersticial spaces to provide escape cover and overwintering habitat for small rearing salmonids. Quality of this habitat component is affected by sedimentation. The main difference is that this substrate size is found in steeper, higher energy stream sections than spawning gravels. Therefore, effects of sedimentation are generally less severe.

This variable was modeled using the "Guide for Predicting Sediment Yields From Forested Watersheds" and "Guide for Predicting Salmonid Response to Sediment Yields in Idaho Batholith Watersheds" (USDA Forest Service 1983). Some revisions of the formulas used in this process were needed. This procedure allows direct estimation of effects of changes in sedimentation on summer and winter rearing habitat. Response curves for relating substrate embeddedness to rearing capacity are shown in Figures E-3 and E-4 (USDA Forest Service 1983).

Average Percent Vegetative Ground Cover And Canopy Cover For Allocthonous Input Along Streambanks During The Summer

The Vegetation Index for this variable is:

$$\begin{array}{rr} & 2\ (\%\ \text{shrubs}) \\ & +1.5\ (\%\ \text{grasses}) \\ & +1.0\ (\%\ \text{trees}) \\ \hline = & \text{Veg. Index} \end{array}$$

This formula indicates the relative importance of the shrub and grass components of riparian vegetation in providing organic inputs such as insects to the stream system. The fire has had a large impact on these components. Post-fire erosion control seeding is also an important consideration. Measures to accelerate recovery of riparian shrubs and trees would be beneficial.

Average Percent Rooted Vegetation And Stable Rocky Ground Cover Along Streambank

This variable is designed to evaluate streambank stability. It is directly related to the above variable. The amount of stable rocky streambank is assumed to remain constant.

Percent fines (less than 3 mm) in riffle-run areas reduces production of aquatic insects which are important food items for trout. An increase in the percent fines in spawning areas also reduces the amount of intergravel flow, which results in higher mortality rates for eggs and alveoli.

This variable was modeled using the "Guide for Predicting Salmonid Response to Sediment Yields in Idaho Batholith Watersheds" (USDA Forest Service 1983). Some revisions of the formulas used in this process were neeeded. This procedure allows direct estimation of the effects of changes in sedimentation on fry survival. It does not address aquatic insect production. The response curve for relating fine sediment by depth to fry emergence is shown in Figure E-1 (USDA Forest Service 1983).

XII. DISSOLVED OXYGEN IN FOREST STREAMS

The dissolved oxygen concentration in small, forest streams strongly influence the character and productivity of the aquatic ecosystem. Fish and other aquatic organisms need dissolved oxygen to survive, grow and develop.

Silvicultural activities may influence the dissolved oxygen concentration of a stream draining a logged area. If timber harvesting exposes the stream to direct solar radiation, the water temperature will increase, resulting in a decrease in the saturation of dissolved oxygen in the water. In addition, if large quantities of organic debris are allowed to remain in the stream channel over an extended period, they may contribute to decreased dissolved oxygen levels by: (1) forming debris ponds, which enhance heating of water and reduce the reaeration rate; (2) releasing dissolve chemicals, such as sugars, nutrients, and phenolics, which are readily oxidized by microorganisms; and (3) forming a algae mat that can inhibit the flow of dissolved oxygen into the intragravel water.

It is not possible to accurately predict the impact of silvicultural activities on the dissolved oxygen concentration of forest streams. The physiochemical properties of oxygen solubility, the pool and riffle nature of mountain streams, and the non-point source pollution affecting dissolved oxygen concentration makes such prediction very difficult. For the Tepee project however, it is possible to plan silviculture activities so that no additional influence on dissolved oxygen reduction can occur. The primary mechanism used for achieving this is to prevent any additional loss of perennial stream shade and thereby prevent any additional stream temperature increase. Second in importance is to prevent any logging slash (needles and branches) from remaining in any streamcourse including intermittent Class IV's. Both of these BMP's are to be used in conjunction with implementation of the Tepee management Alternatives.

Because of:

- the use of these maximum precautionary mitigative measures, and

- because the Tepee Butte streams are quite steep (mostly greater than 6 percent gradient), which will provide much turbulence that will constantly act to reaerate stream water for maximum oxygen content,

a simple method was used to determine dissolved oxygen content of stream water.

In fresh water, the maximum amount of oxygen that can be dissolved in water (saturation concentration) is determined by atmospheric pressure and water temperature. For the Tepee analysis, equations that are in standard use were used to calculate dissolved oxygen depending upon the typical elevation (atmospheric pressure) and the maximum water temperatures obtained for various fish analysis points and years after fire (as described in section III of this paper). The result is the dissolved oxygen quantitative values that were in turn used to assess the effects on fish production (see section IX of this paper.

XIII DATA TABLES FOR SEDIMENT, WATER TEMPERATURE AND DISSOLVED OXYGEN -- LISTED BY EIS ALTERNATIVE

Quantitative data compilation by alternative for sediment, water temperature and dissolved oxygen --

ALTERNATIVE A - NO ACTION

Sediment --

-- Sediment output

	Analysis		Area Above Point	Sediment Yield (tons/square mile)		
Stream	Location	Point	(Square Miles)	Natural	5-year average	1st year 1989
Cherry	middle	4	12.05	17.8	25.4	51.7
	mouth	5	19.41	28.1	31.2	50.5
Cook	middle	5	11.71	11.7	33.6	72.1
	mouth	7	27.83	30.2	41.6	74.4
Cotton-wood	middle	6	11.31	15.1	28.6	55.8
	fire bndy	8	24.83	21.2	36.0	74.2

Notes - Sediment yield is suspended sediment plus bedload.

Multiply area times tons/miles squared if want to see total tons yielded.

Soil eroded from streambanks by peakflows was judged inconsequential.

Stream Temperature --

-- Temperature output

Analysis			Maximum Stream Temperature (Degrees Fahrenheit)			
Stream	Location	Point	Prefire	1st Year	10-year average	Last 5-yr average
Cherry	middle	4	56	69	63	60
	mouth	5	65	69	64	61
Cook	middle	5	58	88	77	69
	mouth	7	63	88	77	69
Cotton-wood	middle	6	56	88	73	63
	fire bndy	8	68	87	72	64

Dissolved oxygen –

Analysis			Dissolved Oxygen (Milligrams/liter)			
Stream	Location	Point	Prefire	1st Year	10-year Average	Last 5-yr average
Cherry	middle	4	9.2	7.9	8.4	8.7
	mouth	5	8.3	7.9	8.3	8.6
Cook	middle	5	8.9	6.4	7.3	7.9
	mouth	7	8.4	6.4	7.3	7.9
Cottonwood	middle	6	9.2	6.4	7.7	8.4
	fire bndy	8	8.0	6.5	7.7	8.3

ALTERNATIVE G

Sediment -

- Sediment output

	Analysis		Area Above Point	Sediment Yield (tons/square mile)				
Stream	Location	Point	(Square Miles)	Prefire Natural	No Action	Alt. G.	No Action	Alt. G
Cherry	middle	4	12.05	17.8	25.4	25.6	51.7	51.7
	mouth	5	19.41	28.1	31.2	31.4	50.5	50.5
Cook	middle	5	11.71	11.7	33.6	33.6	72.1	72.2
	mouth	7	27.83	30.2	41.6	41.6	74.4	74.5
Cotton-wood	middle	6	11.31	15.1	28.6	29.2	55.8	56.8
	fire bndy	8	24.83	21.2	36.0	36.4	74.2	75.2

Notes -

- Sediment yield is suspended sediment plus bedload.

- Multiply area times tons/miles squared if want to see total tons yielded.

- "Alt." includes No Action -- this is a cumulative effect.

- Soil eroded from streambanks by peakflows was judged inconsequential.

-- Sediment output change for Alternative G versus No Action A

	Analysis		Percent Change	
Stream	Location	Point	5-yr Average-%	1st yr 1989-%
Cherry	middle	4	+0.8	.0
	mouth	5	+0.6	.0
Cook	middle	5	.0	+0.1
	mouth	7	.0	+0.1
Cotton-wood	middle	6	+2.1	+1.8
	fire bndy	8	+1.1	+1.3

Stream Temperature --

-- Temperature output

			Maximum Stream Temperature (Degrees Fahrenheit)					
Analysis				First Year	10-yr Average		Last 5-yr Average	
Stream	Location	Point	Prefire	Both Alts.	No Action	Alt. G	No Action	Alt. G
Cherry	middle	4	56	69	63	63	60	60
	mouth	5	65	69	64	64	61	61
Cook	middle	5	58	88	77	77	69	68
	mouth	7	63	88	77	77	69	68
Cotton-wood	middle	6	56	88	73	72	63	61
	fire bndy	8	68	87	72	71	64	61

- Alt. includes No Action -- this is a cumulative effect

-- Temperature output change for Alternative G versus No Action A

Increase - there will be no increase

Decrease -

	Analysis		Percent Change	
Stream	Location	Point	10-yr Average-%	Last 5-yr Average-%
Cherry	middle	4	.0	.0
	mouth	5	.0	.0
Cook	middle	5	.0	-1.0
	mouth	7	.0	-1.0
Cotton-wood	middle	6	-1.0	-3.0
	fire bndy	8	-1.0	-5.0

Dissolved Oxygen –

– Dissolved Oxygen Output

			Dissolved Oxygen (milligrams/liter)					
Analysis				First Year	10-yr Average		Last 5-yr Average	
Stream	Location	Point	Prefire	Both Alts.	No Action	Alt. G	No Action	Alt. G
Cherry	middle	4	9.2	7.9	8.4	8.4	8.7	8.7
	mouth	5	8.3	7.9	8.3	8.3	8.6	8.6
Cook	middle	5	7.3	6.4	7.3	7.3	7.9	8.0
	mouth	7	7.3	6.4	7.3	7.3	7.9	8.0
Cotton-wood	middle	6	9.2	6.4	7.7	7.7	8.4	8.6
	fire bndy	8	7.7	6.5	7.7	7.8	8.3	8.6

- Alt. includes No Action – this is a cumulative effect

– Dissolved oxygen output change for Alternative G versus No Action A

Increase - there will be no increase

Decrease -

	Analysis		Percent Change	
Stream	Location	Point	10-yr Average-%	Last 5-yr Average-%
Cherry	middle	4	.0	.0
	mouth	5	.0	.0
Cook	middle	5	.0	+1.0
	mouth	7	.0	+1.0
Cotton-wood	middle	6	.0	+2.0
	fire bndy	8	+1.0	+4.0

ALTERNATIVE H

Sediment -

- Sediment output

	Analysis		Area Above Point	Sediment Yield (tons/square mile)				
Stream	Location	Point	(Square Miles)	Prefire Natural	No Action	Alt. H.	No Action	Alt. H
Cherry	middle	4	12.05	17.8	25.4	25.4	51.7	51.7
	mouth	5	19.41	28.1	31.2	31.3	50.5	50.5
Cook	middle	5	11.71	11.7	33.6	33.6	72.1	72.2
	mouth	7	27.83	30.2	41.6	41.6	74.4	74.5
Cottonwood	middle	6	11.31	15.1	28.6	28.7	55.8	56.0
	fire bndy	8	24.83	21.2	36.0	36.2	74.2	74.5

Notes -

- Sediment yield is suspended sediment plus bedload.
- Multiply area times tons/miles squared if want to see total tons yielded.
- "Alt." includes No Action -- this is a cumulative effect.
- Soil eroded from streambanks by peakflows was judged inconsequential.

-- Sediment output change for Alternative H versus No Action A

	Analysis		Percent Change	
Stream	Location	Point	5-yr Average-%	1st yr 1989-%
Cherry	middle	4	.0	.0
	mouth	5	+0.3	.0
Cook	middle	5	.0	+0.1
	mouth	7	.0	.0
Cottonwood	middle	6	+0.3	+0.4
	fire bndy	8	0.6	+0.5

Stream Temperature –

– Temperature output

			Maximum Stream Temperature (Degrees Fahrenheit)					
Analysis				First Year	10-yr Average		Last 5-yr Average	
Stream	Location	Point	Prefire	Both Alts.	No Action	Alt. H	No Action	Alt. H
Cherry	middle	4	56	69	63	63	60	60
	mouth	5	65	69	64	64	61	61
Cook	middle	5	58	88	77	77	69	69
	mouth	7	63	88	77	77	69	69
Cotton-wood	middle	6	56	88	73	73	63	63
	fire bndy	8	68	87	72	72	64	64

- Alt. includes No Action – this is a cumulative effect

– Temperature output change for Alternative H versus No Action A

Increase - there will be no increase

Decrease -

	Analysis		Percent Change	
Stream	Location	Point	10-yr Average-%	Last 5-yr Average-%
Cherry	middle	4	.0	.0
	mouth	5	.0	.0
Cook	middle	5	.0	-1.0
	mouth	7	.0	-1.0
Cotton-wood	middle	6	-1.0	-3.0
	fire bndy	8	-1.0	-5.0

Dissolved Oxygen –

– Dissolved Oxygen Output

			Dissolved Oxygen (milligrams/liter)					
Analysis				First Year	10-yr Average		Last 5-yr Average	
Stream	Location	Point	Prefire	Both Alts.	No Action	Alt. H	No Action	Alt. H
Cherry	middle	4	9.2	7.9	8.4	8.4	8.7	8.7
	mouth	5	8.3	7.9	8.3	8.3	8.6	8.6
Cook	middle	5	7.3	6.4	7.3	7.3	7.9	7.9
	mouth	7	7.3	6.4	7.3	7.3	7.9	7.9
Cotton-wood	middle	6	9.2	6.4	7.7	7.7	8.4	8.4
	fire bndy	8	7.7	6.5	7.7	7.7	8.3	8.3

- Alt. includes No Action – this is a cumulative effect

– Dissolved oxygen output change for Alternative G versus No Action A

Increase - there will be no increase

Decrease -

	Analysis		Percent Change	
Stream	Location	Point	10-yr Average-%	Last 5-yr Average-%
Cherry	middle	4	.0	.0
	mouth	5	.0	.0
Cook	middle	5	.0	.0
	mouth	7	.0	.0
Cotton-wood	middle	6	.0	.0
	fire bndy	8	.0	.0

ALTERNATIVE I

Sediment -

- Sediment output

	Analysis		Area Above Point	Sediment Yield (tons/square mile)				
Stream	Location	Point	(Square Miles)	Prefire Natural	No Action	Alt. I.	No Action	Alt. I
Cherry	middle	4	12.05	17.8	25.4	25.4	51.7	51.7
	mouth	5	19.41	28.1	31.2	31.2	50.5	50.5
Cook	middle	5	11.71	11.7	33.6	33.6	72.1	72.1
	mouth	7	27.83	30.2	41.6	41.6	74.4	74.4
Cotton-wood	middle	6	11.31	15.1	28.6	28.6	55.8	55.8
	fire bndy	8	24.83	21.2	36.0	36.0	74.2	74.2

Notes -

- Sediment yield is suspended sediment plus bedload.

- Multiply area times tons/miles squared if want to see total tons yielded.

- "Alt." includes No Action -- this is a cumulative effect.

- Soil eroded from streambanks by peakflows was judged inconsequential.

-- Sediment output change for Alternative I versus No Action A

	Analysis		Percent Change	
Stream	Location	Point	5-yr Average-%	1st yr 1989-%
Cherry	middle	4	.0	.0
	mouth	5	.0	.0
Cook	middle	5	.0	.0
	mouth	7	.0	.0
Cotton-wood	middle	6	.0	.0
	fire bndy	8	.0	.0

Stream Temperature –

– Temperature output

			Maximum Stream Temperature (Degrees Fahrenheit)					
Analysis				First Year	10-yr Average		Last 5-yr Average	
Stream	Location	Point	Prefire	Both Alts.	No Action	Alt. I	No Action	Alt. I
Cherry	middle mouth	4 5	56 65	69 69	63 64	63 64	60 61	60 61
Cook	middle mouth	5 7	58 63	88 88	77 77	77 77	69 69	68 68
Cotton-wood	middle fire bndy	6 8	56 68	88 87	73 72	72 71	63 64	61 61

- Alt. includes No Action – this is a cumulative effect

– Temperature output change for Alternative I versus No Action A

Increase - there will be no increase

Decrease -

	Analysis		Percent Change	
Stream	Location	Point	10-yr Average-%	Last 5-yr Average-%
Cherry	middle mouth	4 5	.0 .0	.0 .0
Cook	middle mouth	5 7	.0 .0	-1.0 -1.0
Cotton-wood	middle fire bndy	6 8	-1.0 -1.0	-3.0 -5.0

Dissolved Oxygen --

-- Dissolved Oxygen Output

			Dissolved Oxygen (milligrams/liter)					
Analysis				First Year	10-yr Average		Last 5-yr Average	
Stream	Location	Point	Prefire	Both Alts.	No Action	Alt. I	No Action	Alt. I
Cherry	middle	4	9.2	7.9	8.4	8.4	8.7	8.7
	mouth	5	8.3	7.9	8.3	8.3	8.6	8.6
Cook	middle	5	7.3	6.4	7.3	7.3	7.9	8.0
	mouth	7	7.3	6.4	7.3	7.3	7.9	8.0
Cottonwood	middle	6	9.2	6.4	7.7	7.7	8.4	8.6
	fire bndy	8	7.7	6.5	7.7	7.8	8.3	8.6

- Alt. includes No Action -- this is a cumulative effect

-- Dissolved oxygen output change for Alternative I versus No Action A

Increase - there will be no increase

Decrease -

	Analysis		Percent Change	
Stream	Location	Point	10-yr Average-%	Last 5-yr Average-%
Cherry	middle	4	.0	.0
	mouth	5	.0	.0
Cook	middle	5	.0	+1.0
	mouth	7	.0	+1.0
Cottonwood	middle	6	.0	+2.0
	fire bndy	8	+1.0	+4.0

ALTERNATIVE J

Sediment -

- Sediment output

	Analysis		Area Above Point	Sediment Yield (tons/square mile)				
Stream	Location	Point	(Square Miles)	Prefire Natural	No Action	Alt. J.	No Action	Alt. J
Cherry	middle	4	12.05	17.8	25.4	25.5	51.7	51.7
	mouth	5	19.41	28.1	31.2	31.4	50.5	50.5
Cook	middle	5	11.71	11.7	33.6	33.6	72.1	72.2
	mouth	7	27.83	30.2	41.6	41.6	74.4	74.5
Cottonwood	middle	6	11.31	15.1	28.6	28.9	55.8	56.4
	fire bndy	8	24.83	21.2	36.0	36.3	74.2	74.9

Notes -

- Sediment yield is suspended sediment plus bedload.
- Multiply area times tons/miles squared if want to see total tons yielded.
- "Alt." includes No Action -- this is a cumulative effect.
- Soil eroded from streambanks by peakflows was judged inconsequential.

-- Sediment output change for Alternative J versus No Action A

	Analysis		Percent Change	
Stream	Location	Point	5-yr Average-%	1st yr 1989-%
Cherry	middle	4	+0.4	.0
	mouth	5	+0.6	.0
Cook	middle	5	.0	+0.1
	mouth	7	.0	+0.1
Cottonwood	middle	6	+1.0	+1.1
	fire bndy	8	+0.8	+0.9

Stream Temperature --

-- Temperature output

			Maximum Stream Temperature (Degrees Fahrenheit)					
Analysis				First Year	10-yr Average		Last 5-yr Average	
Stream	Location	Point	Prefire	Both Alts.	No Action	Alt. J	No Action	Alt. J
Cherry	middle	4	56	69	63	63	60	60
	mouth	5	65	69	64	64	61	61
Cook	middle	5	58	88	77	77	69	69
	mouth	7	63	88	77	77	69	69
Cotton-wood	middle	6	56	88	73	73	63	63
	fire bndy	8	68	87	72	72	64	64

- Alt. includes No Action -- this is a cumulative effect

-- Temperature output change for Alternative J versus No Action A

Increase - there will be no increase

Decrease -

	Analysis		Percent Change	
Stream	Location	Point	10-yr Average-%	Last 5-yr Average-%
Cherry	middle	4	.0	.0
	mouth	5	.0	.0
Cook	middle	5	.0	.0
	mouth	7	.0	.0
Cotton-wood	middle	6	.0	.0
	fire bndy	8	.0	.0

Dissolved Oxygen –

– Dissolved Oxygen Output

			Dissolved Oxygen (milligrams/liter)						
Analysis				First Year	10-yr Average		Last 5-yr Average		
Stream	Location	Point	Prefire	Both Alts.	No Action	Alt. J	No Action	Alt. J
Cherry	middle	4	9.2	7.9	8.4	8.4	8.7	8.7
	mouth	5	8.3	7.9	8.3	8.3	8.6	8.6
Cook	middle	5	7.3	6.4	7.3	7.3	7.9	7.9
	mouth	7	7.3	6.4	7.3	7.3	7.9	7.9
Cotton-wood	middle	6	9.2	6.4	7.7	7.7	8.4	8.4
	fire bndy	8	7.7	6.5	7.7	7.7	8.3	8.3

- Alt. includes No Action – this is a cumulative effect

– Dissolved oxygen output change for Alternative J versus No Action A

Increase - there will be no increase

Decrease -

	Analysis		Percent Change	
Stream	Location	Point	10-yr Average-%	Last 5-yr Average-%
Cherry	middle	4	.0	.0
	mouth	5	.0	.0
Cook	middle	5	.0	.0
	mouth	7	.0	.0
Cotton-wood	middle	6	.0	.0
	fire bndy	8	.0	.0

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APPENDIX C

VISUAL RESOURCE CUMULATIVE EFFECTS

CUMULATIVE EFFECTS ANALYSIS

VISUAL RESOURCE

TEPEE BUTTE FIRE RECOVERY PROJECT
By
Gary Loeffler, Landscape Architect

This report addresses what cumulative effects the action alternatives will have on the visual resource within the Tepee Butte Recovery Project and on the recreation settings and recreation opportunities in the project area.

In order to accurately provide an analysis of cumulative effects, the natural character of the NRA landscape has been used to describe the base from which all assessments are made.

Visual Management System

Sensitivity Level--Several elements are included in this analysis of the visual resource of the project area. Sensitivity Level refers to the number and category of people who view the forest landscape. The sensitivity level of a landscape increases with the numbers of recreation oriented visitors who use the area. The most sensitive (Level 1) travel route is the Snake River. The moderately sensitive (Level 2) travel routes are Wellamotkin Drive (Road 46) and the Cold Spring Road (Road 4680).

Variety Class--Landscape *character types* are used as a frame of reference for classifying the physical features or the degree of scenic value and variety in a given area. The project area is located entirely within the Blue Mountains Character Type (Fenneman 1931), a large province in eastern Oregon. Three classes within this landscape character type are: Variety Class A - Distinctive; Variety Class B - Common; and Variety Class C - Minimal. Approximately 80 percent of the area is Variety Class A. This class includes landscapes dominated by steep canyons, frequent rock outcrops, and varied vegetative patterns. Roughly 20 percent of the project area is comprised of Variety Class B. Moderately scenic, broad, flat ridgetops and gentler rolling terrain with less varied vegetative patterns are found within these areas. There are no Variety Class C landscapes (dull or monotonous scenery) within the project area.

Distance Zone--A third element of visual analysis is the concept of distance and visual impact. As distance from the viewer to an activity increases, the noticeable details and impact of the area are reduced. A viewed activity is considered to be in one of three distance zones. The Foreground (fg) extends from the viewer to 1/2 mile, Middleground (mg) from 1/2 to 5 miles, and Background (bg) is beyond 5 miles from the viewer.

Visual Quality Objective--In order to develop management objectives for the visual resources of Hells Canyon NRA, a visual resource inventory was completed in 1978. Using landscape variety classes, viewer sensitivity levels, and viewer distance zones, Visual Quality Objectives (VQOs) were established and documented in the Hells Canyon NRA Visual Resource Inventory and Imnaha Valley Study (Edaw Inc.1978). These documents are available in the Wallowa-Whitman National Forest's Supervisors Office. They were used to determine the amount of alteration any portion of Hells Canyon NRA could sustain without jeopardizing its visual quality. Arraying these values, five categories of VQOs were identified for the Hells Canyon NRA.

Preservation allows ecological changes only.

Retention provides for management activities which are not visually evident to the casual forest visitor.

Partial Retention permits management activities to be evident, but they must remain visually subordinate to the characteristic landscape.

Modification permits management activities which may visually dominate the characteristic landscape, but should appear natural when viewed at middleground or background distances.

Maximum Modification permits management activities which may visually dominate the characteristic landscape when viewed as foreground or middleground, but should appear natural when viewed as background.

Three of these VQO's pertain to the project area. They are Partial Retention, Modification and Maximum Modification.

In the traditional assessment of management activity impacts on the Visual Resource, acres of activity (usually timber harvesting) which do not meet the VQOs are displayed as negative impacts. However, in the case of the Tepee Butte Fire Recovery Project these harvest acres will occur all at one time, rather than in various entries in an assumed 90-110 year rotation cycle. The term "disturbance-at-one-time" is a visual objective which addresses how much management activity could occur in a given time period.

In other words, even though a group of harvest units individually meet the VQO assigned to an area, as a group they impact too much area; they disturb or change too much of the natural landscape during one period of time. About 20 years is required for a regenerated clearcut to grow trees approximately 20 feet tall, the height required to return a continuous textured landscape. The amount of disturbance allowed in any given area over a 20-year period is the maximum disturbance-at-one-time, or, simply, Maximum Disturbance.

The impacts of harvest activity were calculated against harvest constraints identified in the Forest Planning process. Harvest constraints and their derivation are documented in the Wallowa-Whitman National Forest Visual Management Plan-Desired Visual Model (1980), which is on file in the Wallowa-Whitman National Forest Supervisors Office. Harvest constraints are listed by these Visual Quality Objectives:

VQO	**Maximum Disturbance Threshold**
Partial Retention (Foreground)	3-7% of the area within a viewshed harvested per decade; no more than 14% of the area may be in a disturbed condition at any one time (MDT).
Partial Retention (Middleground)	8-10% of the area within a viewshed harvested per decade; no more than 20% of the area may be in a disturbed condition at any one time (MDT).

Modification	No more than 30% of the area may be in a disturbed condition at any one time
(Middleground)	(MDT). (This 30% figure is not found in the Desired Visual Model, but instead is interpolated from the above figures and similar work done on the Siskiyou National Forest (Pugh 1981).

The following table displays Maximum Disturbance Threshold for the three Visual Quality Objectives

	Visual Quality Objectives		
	PR(fg)	PR(mg)	M(mg)
Maximum Disturbance Threshold	14%	20%	30%

Method of Assessment

Viewsheds were used as the base from which the effects of salvage were calculated. A viewshed is defined as an area visible from viewpoints within or adjacent to a specific area usually contained by topography (similar to a watershed). Harvest impacts on each viewshed should meet the Maximum Disturbance Thresholds for each VQO. Six viewsheds have been delineated within the project area:

Viewshed	**Acres**
Scenic Snake River	11,727
Cottonwood Creek	12,864
Cold Spring Creek	6,058
Cook Creek	19,141
Cherry Creek	14,530
Wellamotkin	5,429

Viewpoints critical to each of the viewsheds were identified and are used in this analysis. They are located along these travel routes: 1) Wellamotkin Drive (46), 2) the Cold Spring Road (Road 4680), 3) the Cottonwood Creek Trail (1696), 4) the Cook Creek Trail (1697), Eureka Creek Trail (1732), Deadhorse Creek Trail (1708), and Five Points Creek Trail (1697a). Proposed harvest units and roads were modeled on computer-simulated landscapes (NewPerspectives) to determine the disturbance to viewsheds as seen from critical viewpoints.

Silvicultural Systems The effects of salvage harvest are most evident in terms of the reduction or removal of vegetative cover. Contrast in the texture of the managed area and the vegetative canopy of the surrounding natural landscape is greatest when silvicultural clearcuts are employed. Contrast is less evident when partial cuts are employed and some vegetation is retained after harvest.

Due to the direction provided by the Comprehensive Management Plan for timber harvest activity (no opening will be created which is greater than 2 acres), salvage activity will result in varying degrees of partial-cut units. No even-aged management or regeneration clearcut units will be allowed. For this reason the Cumulative Effects Analysis, which usually relates to visual disturbance in the form of created openings (clearcuts), must instead judge the impacts of removing individual trees and relatively small groups of trees (partial-cuts).

To determine what degree of impact partial-cutting will create, it was decided that by using stand basal area an array of partial-cut densities and their resulting Visual Impacts (high, moderate, low, none) could be created. Two assessment elements were needed: Remaining Crown Density and Removed Tree (stump) Density.

Remaining Crown Density totals the remaining green (live) trees over 4 inches in diameter (usually at least 20 feet in height) and the black (dead and severely damaged) trees not harvested. These black trees, because they will not provide the same crown closure or screening, will be given a 3/1 equivalency rate. The following table displays this element:

REMAINING CROWN DENSITY

Visual Impact	*Basal Area*	*Description **
High	less than 60 sq ft	Understocked up to Heavy Shelterwood Stocking
Moderate	60-79 sq ft	Heavy Shelterwood Stocking up to Minimum Stocking
Low	80-119 sq ft	Minimum Stocking up to Recommended Stocking
None	120 sq ft or greater	Recommended Stocking up to Overstocked

* These descriptions are usually associated with even-aged management. They are used here only to create a mental image, and are not to be confused with the uneven-aged/ group selection management practiced in the NRA.

The second element, Removed Tree (Stump) Density, will total the amount of trees by basal area that are removed in relation to the amount existing before harvest. (After harvest some stands may provide enough crowns cover to create a low visual impact, but because the stand was relatively dense, the number of stumps provided (generally a foreground concern) would create a high visual impact.)

The following table shows this element:

REMOVED TREE (STUMP) DENSITY

Visual Impact	*Basal Area*	*Description*
High	120 sq ft or greater	High or greater
Moderate	80-119 sq ft	Moderate to High
Low	60-79 sq ft	Low to Moderate
None	less than 60 sq ft	None to Low

Logging Systems used during salvage generate a range of effects which will vary in intensity and duration. Three systems are proposed for this project: 1) Helicopter, 2) Skyline cable, and 3) Tractor.

Helicopter systems provide managers with the greatest opportunity to manipulate harvest operations to blend activities' effects with the surrounding landscape. Trees can be harvested selectively by helicopter. Unit size and shape can be varied in great detail. Salvage areas can be designed to appear more natural after harvest. Long-term evidence of salvage is reduced by helicopter logging, because disturbance to soils and residual vegetation is minimal. Landings are usually larger and are located central to salvage areas. Road construction is reduced since access is not required for all units.

Skyline cable systems provide limited opportunities for managers to blend salvage units into the characteristic landscape. Opportunities to reduce visual impacts are limited too, because unit boundaries are necessarily more defined. Unit shapes tend to be more geometric when a skyline system is used. Soil disturbance is greater and remains evident for longer. Skyline corridors used for yarding logs to the landing will create visual lines that will be evident. Landings will also be visible where skyline corridors converge. Generally, at least one landing is required for each unit. Roads are required to access units and are typically located in visually sensitive ridgetop or midslope locations.

Tractor systems are used in areas where slopes are moderate. Compaction from the treads of the machine, and from the yarding of logs, significantly impacts the the landscape. Soil disturbance is greatest when this system is used. Unit size and shape can be manipulated to blend with the landscape, but tend to remain evident longer due to skid trails used for yarding, the number of landings used, and the necessary access roads.

For the purposes of this assessment, units which are proposed to be logged with the helicopter system will have an impact factor of 1; those harvested with the tractor system an impact factor of 1.5, and those harvested with the skyline cable system an impact factor of 2.75. (It is assumed that the tractor system will impact the visual resource less than the skyline system. This is because very few new roads will be built and the tractor ground is generally well screened. In addition, tractor operations will be performed over gentle slopes which won't allow perpendicular views into exposed ground surfaces.)

Visual Absorption Capability (VAC) is a visual inventory which assesses the ability of the natural landscape to "absorb" management activities. Attributes such as regeneration potential, slope, soil color contrast, vegetative screening potential, etc., are compiled to produce High, Moderate or Low visual absorption capabilities.

It was determined that VAC was **not** a necessary element in this analysis, for the following reasons: 1) Due to vegetative or topographic screening, much of the salvage activity will occur in areas which are generally not seen from sensitive viewpoints. 2) Timber in very few units is proposed to be harvested by skyline systems (greatest visual impact). 3) All units will be partial-cuts, rather than clearcuts, because CMP guidelines will be followed. 4) Good natural regeneration potential exists, especially the shrub component, because of productive soils and the site preparation effect of the fire.

Visual Cumulative Effects are derived by the following process:

A. Harvest units are delineated by the VQO area in which they are located, then overlaid by their viewshed location (Viewshed VQOs). The combined visual inventory acres become the base acres impacted by the harvest system.

B. The Remaining Crown Density and the Removed Tree Density of the harvest units are assessed as None (value factor 1), Low (value factor 2), Moderate (value factor 3), and High (value factor 4).

C. These silvicultural factors are then combined with logging system values: Sykline--high impact (value factor 2.75), tractor--moderate impact (value factor 1.50), or helicopter--low impact (value factor 1.0).

D. These Combined Disturbance Acres are then grouped into three levels of Visual Disturbance Impacts as follows:

Visual Disturbance Impacts	*Combined Disturbance Value Factors*
LOW VDI	0--------5.375
MODERATE VDI	5.376----8.0625
HIGH VDI	8.0626--10.75

E. Maximum Disturbance Thresholds were developed for each level of Visual Disturbance Impact (Low, Moderate and High VDI) for each Visual Quality Objective. These were developed using the Wallowa-Whitman National Forest's "Desired Visual Model (1980)"; *Scheduling Timber Harvest* (Pugh 1981); and *Visual Resource Assessment in Mathematic Models for National Forest Land Use Planning* (Iverson 1985). Adjustments were made for the group selection/partial-cut prescriptions which will be administered. It was felt that most partial-cuts located in middleground views create subtle differences in textural changes that go unnoticed by the untrained viewer. A 20 percent increase in Maximum Disturbance Thresholds was, therefore, acceptable. However, in foreground situations the accumulation of stumps and logging slash would allow only a 10 percent increase in MDTs as follows:

Visual Disturbance Impact	Visual Quality Objective Maximum Disturbance Threshold		
	PR(fg)	PR(mg)	M(mg)
Low VDI	26%	43%	54%
Moderate VDI	24%	40%	50%
High VDI	22%	37%	46%

To determine each VDI's proportionate share of each Maximum Disturbance Threshold, a weighted equivalent MDT percent was created. When harvest impacts in a given viewshed's VQO area approach or exceed this weighted average MDT, the appropriate box in the cumulative effects table is grey toned. (see Tables G, H, and J)

Visual Cumulative Effects (Maximum Disturbance) Alternative G - DEIS

Cottonwood Creek	Cold Springs Creek	Wellamotkin	Cook Creek	Cherry Creek	Scenic Snake
PR(fg) 867 VDI: L M H 10 167 53 w/a 27% w/a MDT 21%	PR(fg) 2386 VDI: L M H 26 100 0 w/a 5% w/a MDT 22%	**PR(fg) 4567 VDI: L M H 119 707 184 w/a 22% w/a MDT 21%**	PR(fg) 699 VDI: L M H 0 51 0 w/a 7% w/a MDT 22%	PR(fg) 0 VDI: L M H 0 0 0 w/a 0.0% w/a MDT 0%	PR(fg) – VDI: L M H – – -- w/a --% w/a MDT --%
PR(mg) 8947 VDI: L M H 104 603 24 w/a 8% w/a MDT 40%	PR(mg) 2743 VDI: L M H 32 4 0 w/a 1% w/a MDT 43%	PR(mg) 281 VDI: L M H 0 12 8 w/a 7% w/a MDT 39%	PR(mg) 17962 VDI: L M H 18 7 0 w/a 0.1% w/a MDT 42%	PR(mg) 13183 VDI: L M H 38 15 10 w/a 0.5% w/a MDT 41%	PR(mg) --- VDI: L M H – – -- w/a --% w/a MDT --%
M(mg) 3050 VDI: L M H 72 610 124 w/a 26% w/a MDT 50%	M(mg) 929 VDI: L M H 0 0 0 w/a 0.0% w/a MDT 46%	M(mg) 581 VDI: L M H 30 129 21 w/a 31% w/a MDT 50%	M(mg) 480 VDI: L M H 7 31 0 w/a 8% w/a MDT 51%	M(mg) 1347 VDI: L M H 91 74 21 w/a 14% w/a MDT 52%	M(mg) – VDI: L M H – – -- w/a --% w/a MDT --%

Inventoried Acres

PR(fg) - Partial Retention (foreground)
PR(mg) - Partial Retention (middleground)
M(mg) - Modification (middleground)

L - Low
M - Mod.
H - High

VDI - Visual Disturbance Impacts

MDT - Maximum Disturbance Threshold

w/a - Weighted Average

Grey toned areas indicate Thresholds approached or exceeded

Visual Cumulative Effects (Maximum Disturbance) Alternative H - DEIS

Cottonwood Creek	Cold Springs Creek	Wellamotkin	Cook Creek	Cherry Creek	Scenic Snake
PR(fg) 867 VDI: L M H 10 48 14 w/a 8% w/a MDT 21%	PR(fg) 2386 VDI: L M H 23 40 0 w/a 3% w/a MDT 23%	PR(fg) 4567 VDI: L M H 92 102 59 w/a 6% w/a MDT 21%	PR(fg) 699 VDI: L M H 0 8 0 w/a 1% w/a MDT 22%	PR(fg) 0 VDI: L M H 0 0 0 w/a 0.0% w/a MDT 0%	PR(fg) -- VDI: L M H -- -- -- w/a --% w/a MDT --%
PR(mg) 8947 VDI: L M H 39 189 115 w/a 4% w/a MDT 39%	PR(mg) 2743 VDI: L M H 29 0 0 w/a 1% w/a MDT 43%	PR(mg) 281 VDI: L M H 0 5 0 w/a 2% w/a MDT 40%	PR(mg) 17962 VDI: L M H 18 0 0 w/a 0.1% w/a MDT 43%	PR(mg) 13183 VDI: L M H 0 0 0 w/a 0.0% w/a MDT 37%	PR(mg) -- VDI: L M H -- -- -- w/a --% w/a MDT --%
M(mg) 3050 VDI: L M H 18 195 142 w/a 12% w/a MDT 49%	M(mg) 929 VDI: L M H 0 0 0 w/a 0.0% w/a MDT 46%	M(mg) 581 VDI: L M H 16 25 8 w/a 8% w/a MDT 51%	M(mg) 480 VDI: L M H 5 0 0 w/a 1% w/a MDT 54%	M(mg) 1347 VDI: L M H 38 0 0 w/a 3% w/a MDT 54%	M(mg) -- VDI: L M H -- -- -- w/a --% w/a MDT --%

Inventoried Acres

PR(fg) - Partial Retention (foreground)
PR(mg) - Partial Retention (middleground)
M(mg) - Modification (middleground)

L - Low
M - Mod.
H - High

VDI - Visual Disturbance Impacts

MDT - Maximum Disturbance Threshold

w/a - Weighted Average

Grey toned areas indicate Thresholds approached or exceeded

Visual Cumulative Effects (Maximum Disturbance) Alternative J - DEIS

Cottonwood Creek	Cold Springs Creek	Wellamotkin	Cook Creek	Cherry Creek	Scenic Snake
PR(fg) 867 **VDI:** **L M H** **10 119 53** **w/a 21%** **w/a MDT 20%**	PR(fg) 2386 VDI: L M H 23 65 0 w/a 4% w/a MDT 23%	**PR(fg) 4567** **VDI:** **L M H** **106 595 136** **w/a 18%** **w/a MDT 21%**	PR(fg) 699 VDI: L M H 0 43 0 w/a 6% w/a MDT 22%	PR(fg) 0 VDI: L M H 0 0 0 w/a 0.0% w/a MDT 0%	PR(fg) -- VDI: L M H -- -- -- w/a --% w/a MDT --%
PR(mg) 8947 VDI: L M H 104 366 135 w/a 7% w/a MDT 40%	PR(mg) 2743 VDI: L M H 29 3 0 w/a 1% w/a MDT 43%	PR(mg) 281 VDI: L M H 0 8 9 w/a 6% w/a MDT 38%	PR(mg) 17962 VDI: L M H 18 7 0 w/a 0.1% w/a MDT 42%	PR(mg) 13183 VDI: L M H 33 9 10 w/a 0.4% w/a MDT 41%	PR(mg) --- VDI: L M H -- -- -- w/a --% w/a MDT --%
M(mg) 3050 VDI: L M H 72 422 245 w/a 24% w/a MDT 49%	M(mg) 929 VDI: L M H 0 0 0 w/a 0.0% w/a MDT 46%	M(mg) 581 VDI: L M H 28 118 23 w/a 29% w/a MDT 50%	M(mg) 480 VDI: L M H 5 31 0 w/a 8% w/a MDT 51%	M(mg) 1347 VDI: L M H 63 65 21 w/a 11% w/a MDT 51%	M(mg) -- VDI: L M H -- -- -- w/a --% w/a MDT --%

Inventoried Acres

PR(fg) - Partial Retention (foreground)
PR(mg) - Partial Retention (middleground)
M(mg) - Modification (middleground)

L - Low
M - Mod.
H - High

VDI - Visual Disturbance Impacts

MDT - Maximum Disturbance Threshold

w/a - Weighted Average

Grey toned areas indicate Thresholds approached or exceeded

Conclusions & Recommendations

The use of Maximum Disturbance Thresholds to assess the impacts which salvage harvest would have on the visual resource in a fire recovery project is considered a reasonable approach. Modeling traditional (green) cumulative effects would seem valid because varying burn intensities exist. There are no panoramically blackened landscapes where harvest of large areas of black timber would serve to aid visual recovery.

However, it should be noted that cumulative effects coefficients relate to programs where unharvested timber remains a green, viable portion of the natural landscape. In the Tepee Butte Fire Recovery Project some of the remaining timber is green, some is black and some may become brown (dead) at a later date.

Another limitation of this analysis is that cumulative affects figures relating to the green timber program require spatial distribution as well as distributions over time, in order to meet visual quality objectives. Harvest units in a green program are dispersed spatially in an area within the same entry period (decade), so that two or more clearcuts do not occur adjacent to each other, thus making one large clearcut. Ten or twenty years later adjacent units may be cut, since by then the first units have regenerated and trees are growing, screening soil color contrasts, and beginning to recover the textural element of the landscape. However, in a fire recovery project, partial-cuts are often located adjacent to each other, sometimes in relatively large groups due to burn intensities.

For this reason it is recommended that re-entry into the project area for future green harvests be postponed for approximately 20 years to allow the area to recover visually. This is especially true of those viewsheds where the visual impacts are greatest, such as in the Wellamotkin viewshed. To determine the rate of recovery and also to determine the validity of the analysis assumptions, such as the 2-acre Minimum Opening criteria and the Partial-cut Density elements, a Visual Monitoring Plan for the project will be very important.

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APPENDIX D

BEST MANAGEMENT PRACTICES

BEST MANAGEMENT PRACTICES
For The
PROTECTION OF WATER AND SOIL QUALITY

TEPEE BUTTE FIRE RECOVERY PROJECT
Compiled by
Kenwood Hauter, Hydrologist
Dan Harkenrider, Soil Scientist

INTRODUCTION

This Appendix describes the Best Management Practices (BMPs) for the protection of water and soil quality that would be implemented consistently and equally under and of the the Tepee Butte action alternatives. First is a description of the general process used to develop BMPs.

Best Management Practices (BMPs) are methods, measures, or practices selected to meet non-point source control needs. BMPs include, but are not limited to, structural and non-structural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (40 CFR 130.2, EPA Water Quality Standards Regulation).

BMPs are the primary mechanism to enable the achievement of water quality standards. BMPs are selected and tailored for site-specific conditions to arrive at project level BMPs for the protection of water and soil quality. The process for determining appropriate BMPs and for ensuring their implementation is described. This process will result in controlling or preventing non-point sources of pollution caused by resource management activities and will ensure compliance with the:

> **Clean Water Act of 1972, as amended** (1977 and 1987). Section 319 of the Clean Water Act Amendments of 1987 requires that the States determine those waters that will not meet the goals of the Act, to determine those non-point source activities that are contributing pollution, and to develop a process of determining BMPs to reduce such pollution to the "maximum extent practicable." This Appendix is designed to fulfill the intent of the requirements of Section 319.
>
> **Oregon Administrative Rules** (Chapter 340-41-001-975). Department of Environmental Quality (DEQ). Oregon's Administrative Rules contain water requirements for the protection of identified beneficial uses of water.
>
> **Memorandum of Understanding:** The Oregon Department of Environmental Quality and U.S. Department of Agriculture, Forest Service (2/12/79 and 12/7/82), and "Attachments A and B" referred to in this Memorandum (Implementation Plan for Water Quality Planning on National Forest Lands in the Pacific Northwest 12/78 and Best Management Practices for Range and Grazing Activities on Federal Lands, respectively).

The EPA has certified the Oregon Forest Practices Act regulations as BMPs. The State of Oregon compared Forest Service practices with these State practices and concluded that

Forest Service practices meet or exceed State requirements. As State practices change, comparisons are made to ensure that Forest Service practices meet or exceed these changes. Monitoring and evaluation will determine the need for changes in BMPs and/or State standards.

Forest Services management practices will meet, as a minimum, the substantive State BMP quality standards, and other considerations required by the National Forest Management Act (NFMA), and other authorities, for the protection of soil and water resources.

The general BMPs described herein are site-specific BMP prescriptions to protect beneficial uses and meet water quality objectives. They are developed as part of the NEPA process, with interdisciplinary involvement by a team of individuals that represent several areas of professional knowledge, learning, and skill appropriate for the issues and concerns identified. BMPs also include such requirements as Forest Service manual direction, contract provisions, environmental documents, and Forest Plan Standards and Guidelines. Inherent in prescribing project-level management requirements is recognition of specific water quality objectives which BMPs are designed to achieve.

BMP IMPLEMENTATION PROCESS

In cooperation with the State, the primary strategy for the prevention and control of non-point sources is based on the implementation of BMPs determined necessary for the protection of the identified beneficial uses.

The objective is to identify the most practical means of attaining water quality objectives. Water quality objectives include water quality measures that adequately reflect the needs of identified beneficial uses.

The Forest Service Non-point Source Management System consists of:

1. Selection and design of BMPs based on site-specific conditions, technical, economic and institutional feasibility, and the water quality standards of those waters potentially impacted.

2. Implementation and enforcement of BMPs.

3. Monitoring to ensure that practices are correctly applied as designed.

4. Monitoring to determine the effectiveness of practices in meeting design expectations and in attaining water quality standards.

5. Evaluation of monitoring results and mitigation, where necessary, to minimize impacts from activities in the event BMPs do not perform as expected.

6. Adjustment of BMP design standards and application in the event that beneficial uses are not being protected and water quality standards are not being achieved to the desired level. Evaluation of the appropriateness of water quality criteria to reasonably ensure protection of beneficial uses. Consideration of recommending adjustment of water quality standards.

FORMAT OF BEST MANAGEMENT PRACTICES

Each general Best Management Practice (BMP) listed consists of the Title, Objective, Description, Administration and Responsibility, Reliability and Monitoring. Each section with a brief description follows:

Title: Includes the sequential number of the practice and a brief title.

Description: Further defines the brief title, describes the BMP and, if needed, specifies under what conditions and how the practice is applied. Criteria or standards are described when applicable.

Objective: Describes the objective of or reason for the BMP -- what are the desired results with respect to protecting water or soil quality, including whether the BMP prevents or just minimizes impact.

Responsibility and Administration: Identifies the title of the person(s) responsible for implementing the BMP. If necessary, describes how the practices are expected to be administered, such as by what contract provisions.

Reliability: Provides a qualitative assessment of the expected reliability that the applied practice will have for preventing or minimizing impacts on soil, water quality and beneficial uses. The reliability of each BMP is evaluated with an index that rates it as either Excellent, Good or Fair. The index is determined by use of the following guide:

Definitions:

- Effectiveness -- BMP is expected to meet objective this percentage of time. A rating of less than 60% is considered inadequate and in this case a better, more effective BMP is designated.
- Documented data
  - Literature/research -- must be applicable to area
  - Administrative/monitoring studies -- local or within similar ecosystem
- Irrefutable logic -- most people should come to the same conclusion
- Judgement -- an assertion made by persons who are knowledgeable due to education and/or experience

	Source of Effectiveness Rating			
Effectiveness Rating (%)	Documented data, or Irrefutable logic		Reliability Judgement	Rating
>90	X			Excellent
>90			X	Good
75-90	X			Good
75-90			X	Fair
60-74	X	or	x	Fair

Monitoring: Describes if there will be more than just implementation monitoring of the BMP (implementation monitoring makes certain that BMP is being administered correctly).

BEST MANAGEMENT PRACTICES USED FOR ALL ALTERNATIVES

Preventing Peakflow Increases and Associated Sediment and Turbidity Production

BMP ((1A)) -- Buffer corridors for skidtrails and primary dragtrails.

Description:

Skidtrails produced by
-- ground based skidding
and primary dragtrails produced by
-- one-end suspension skyline
-- cable no-suspension with tractor winching
-- cable no-suspension other than tractor winching
shall be no closer to streamcourses than the distances specified in these tables:

If *no crossdrains* are to exist at day's end within 150 feet of trail section closest to buffer corridor.

Skidtrail or primary dragtrail length above buffer

0-200	200-400	400-600	600-800	800-1000	1000-1200	1200-1400
180	200	220	240	260	280	300

<-------Buffer distance (on either side of streamcourse)------->
All distances are in feet of slope distance

If crossdrains are to exist at day's end within 150 feet of trail section closest to buffer corridor.

Skidtrail/primary dragtrail gradient (%)

0-5%	6-15	16-25	26 plus	Buffer distance (ft)
150ft	100	50	30	-----> 165
115ft	75	40	25	-----> 120
75ft	50	25	15	-----> 80

Waterbar spacing (slope distance feet)

- This BMP does not apply to skidtrails or primary dragtrails over snow or frozen ground as described by BMP 4J.
- The last downslope crossdrain should be at buffer margin.

- If a map is being used, slope distances can be converted to horizontal distance using this equation:

$$\text{horizontal distance} = \text{slope distance} \times \cos[\tan^{-1}(\%\text{gradient as fraction})]$$

  For example 300 feet slope distance on a 60% slope gradient is 257 feet horizontal distance.

- If it is necessary to cross a stream with a skidtrail, this is permissible if the skidtrail is considered like a road and all BMPs pertinent to roads are applied to it.

- A skidtrail is a place where ground based yarding has caused bare soil exposure due to the combined effect of both equipment and log skidding.

- A dragtrail is a place where a log being pulled on the end of a cable has been the only influence in causing bare soil exposure.

- A primary dragtrail is a dragtrail that exists in conjunction with all yarding methods except helicopter, full suspension skyline and ground based skidding. It occurs in-line with the main cable that leads uphill to the yarder, and almost always has multiple log dragging events repeatedly occurring on the single dragtrail location.

Objective: Prevent concentrated water runoff caused by rain and snowmelt from accumulating deeper than one inch on highly disturbed areas. Provide a buffer corridor below places where concentrated runoff can occur that will absorb the runoff into the soil before it reaches a streamcourse where it could become a peakflow increase.

Responsibility: Timber sale operator, through supervision and ultimate responsibility of the Forest Service timber sale administrator.

Reliability: Excellent due to proven effectiveness described by published research that applies to the same geologic and ecoclass types as this area. BMP is designed to provide an assurance of 97% that concentrated runoff from an unusual 50-year recurrence interval rainstorm will not reach a streamcourse. Assurance for lesser rainstorm and all snowmelt events should be close to 100%. (See Appendix B, Watershed Environmental Effects Analysis Process, Section VIII for details.)

Monitoring: A Soil and Water Monitoring Plan will be presented in the Final EIS. Monitoring other than the Implementation type is not required due to the Excellent reliability rating, but because of the high importance of this BMP for protection of both soil and water values, some will be performed anyway.

BMP ((1B)) -- Buffer corridor for secondary dragtrails produced by skyline yarding in a downslope direction.

Description:

Secondary dragtrails produced by skyline yarding in a downslope direction, shall be no closer to a streamcourse than that specified by BMP 1A.

- This BMP does not apply to dragtrails over snow or frozen ground.

- A dragtrail is a place where a log being pulled on the end of a cable has been the only influence in causing bare soil exposure.

  A secondary dragtrail is a dragtrail produced by the mostly side yarding that occurs as logs are pulled either (a) to a carriage which is located on the main cable or (b) to the end of a ground based skidding vehicle.

Objective: Same as BMP 1A plus: The log lift-off dragtrails will tend to funnel runoff downslope towards a final common point -- this is the reason for terminating them (providing the buffer corridor) to prevent the concentrated runoff from reaching a streamcourse.

Responsibility, Reliability: Same as BMP 1A.

Monitoring: Implementation type.

BMP ((1C)) -- Buffer for log landings.

Description:

Log landings shall be no closer than 300 feet to a streamcourse.

- This applies to all periods of the year.

Objective: Provide a buffer corridor below places where concentrated runoff can occur that will absorb the runoff into the soil before it reaches a streamcourse where it could become a peakflow increase.

Responsibility, Reliability: Same as BMP 1A.

Monitoring: Implementation type.

BMP ((1D)) -- Road surface crossdrain spacing.

Description:

When a road is within 300 slope distance feet of a Class I, II, III or IV streamcourse, all completed truck roads used in conjunction with logging activities shall have surface crossdrains in place (and maintained in place during road use) according to the following procedure:

Step 1 -- Choose an initial/preliminary spacing from this table

	Typical surface crossdrain spacing (feet) Road grade (%)									
Bearing Surface	0	2	4	6	8	10	12	14	16	18
Native material with no natural surfacing. Limited strength road	0	123	111	105	99	92	85	76	66	56
Pit-run, grid-rolled, or similar existing natural surfacing. Extended Use road.	0	134	122	115	110	102	95	86	77	66
Crushed rock with unified soil class of GW or GP with 25% or less fines	F. S. engineering guides									

Step 2 -- If road is located in the *middle 1/3* of a slope, space crossdrains *18* feet closer than shown in table; if it is in the *bottom 1/3* of a slope, space *36* feet closer.

Step 3 -- If road is located on an *east* or *west* exposure, space crossdrains *8* feet closer than shown in table; if it is located on a *south* exposure, space *16* feet closer.

Step 4 -- For each *10 percent decrease in steepness* of the sidehill slope from a gradient of 80 percent, space crossdrains *5* feet closer than shown in table.

- Surface crossdrains are drainage dips, Utah dips, opentops, water bars or similar bearing-surface drains -- not ditch relief culverts, as these are not reliably effective on surface types other than the last group in the table. Drainage dips are the best devices, although often other types must be added between them to be able to achieve the desired spacing.
- As will be seen in conjunction with discussion on BMP 1F, these spacings may be reduced to allow for a concurrent reduction in the width of the road runoff buffer corridor.

Objective: Prevent formation of runoff channels that are deeper than 1.2 inches that could be produced during an unusual rainfall event such as a 50-year recurrence interval rainstorm.

Responsibility: Timber sale contractor or purchaser through supervision and ultimate responsibility of the Forest Service Contracting Officer Representative or Engineering Representative.

Reliability: Excellent due to proven effectiveness described by published research that applies to the same geologic and ecoclass types as this area. BMP is designed to provide an assurance of 97% that concentrated runoff from an unusual 50-year recurrence interval rainstorm will not produce a concentrated runoff channel that is deeper than 1.2 inches. Assurance for lesser rainstorm and all snowmelt events should be close to 100%. (See Appendix B, Watershed Environmental Effects Analysis Process, Section VIII for details.)

> **Monitoring**: A Soil and Water Monitoring Plan will be presented in the Final EIS. Monitoring other than the Implementation type is not required due to the Excellent reliability rating, but because of the high importance of this BMP for protection of both soil and water values, some will be performed anyway.

BMP ((1E)) -- Waterbar installation during road construction when rain is forecast.

Description:

When road construction is not completed and when road is within 300 slope distance feet of a streamcourse, waterbar installation shall be required prior to approved permanent drainage features when a 50% chance or greater rainfall is forecast and during periods of periods of inactivity of more than 10 hours.

Objective: Prevent concentrated water runoff caused by rain from accumulating deeper than one inch on highly disturbed areas.

Responsibility: Timber sale contractor or purchaser through supervision and ultimate responsibility of the Forest Service Contracting Officer Representative or Engineering Representative.

Reliability: Good, based on a judgement that the objective will be met more than 90 percent of the time.

Monitoring: A Soil and Water Monitoring Plan will be presented in the Final EIS.

BMP ((1F)) -- Buffer corridors for concentrated road runoff.

Description:

If concentrated road runoff is discharged from surface crossdrains onto an area next to a road, a certain minimum distance is needed below the discharge to allow the water volume to be absorbed into ground before a streamcourse is reached. The distance shall be determined using the following procedure:

Step 1 -- Choose 165 feet (slope distance perpendicular to contours) as a base distance value.

Step 2 -- If the surface crossdrain spacings specified by 1D are shortened then:

$$\text{New filter strip distance} = 165 \times \frac{\text{new spacing}}{\text{old 1D spacing}}$$

Step 3 -- If a flow splitter (energy dissipator) is installed below a surface crossdrain outlet then:

> Multiply 0.5 times 165 feet, or if a new distance is derived in step 2, times that new value.

- Concentrated road runoff is rain (or snowmelt) runoff that flows far enough to produce channels/rills -- it is not sheetflow.

- The buffer distances apply just to the downslope corridor immediately below crossdrain discharge. Zones on road between crossdrain outlets do not have to comply with the corridor distance criteria. This is because they are not supplying concentrated runoff directly off the road-side to area below road. Although the road zones are not producing concentrated runoff, they are producing higher total runoff as sheetflow (relative to non-road situation). This diffuse runoff will be absorbed in the below road area that lies between the buffer corridors -- it will not reach a streamcourse.

- Diffuse sheetflow runoff will also be produced on an outsloped road if the road truly has adequate design and is maintained to remove runoff constantly to the side even during use when road surface is wet. Thus, except at crossdrain discharge outlets, well managed, outsloped roads do not need a buffer for concentrated runoff.

- A flow splitter (energy dissipator) is a berm or log laid on the *contour* which is centered just below the surface crossdrain. These devices will cause 1/2 of the runoff to exit on the right and the other 1/2 on the left after ends of log are reached. Device should be at least 30 feet long, and if a log, should be completely sealed into soil (no leakage) and be at least 1 1/2 feet in diameter. If device gets off-contour, install spacers on low end in ditch to at least get channel to zero grade.

Objective: Provide a buffer corridor below places where concentrated runoff can occur that will absorb the runoff into the soil before it reaches a streamcourse where it could become a peakflow increase.

Responsibility: Design engineers, and Forest Service Contracting Officer Representative or Engineering Representative for the crossdrain and flow splitter implementation aspects.

Reliability: Excellent due to proven effectiveness described by published research that applies to the same geologic and ecoclass types as this area. BMP is designed to provide an assurance of 97% that concentrated runoff from an unusual 50-year recurrence interval rainstorm will not reach a streamcourse. Assurance for lesser rainstorm and all snowmelt events should be close to 100%. (See Appendix B, Watershed Environmental Effects Analysis Process, Section VIII for details.)

Monitoring: A Soil and Water Monitoring Plan will be presented in the Final EIS. Monitoring other than the Implementation type is not required due to the Excellent reliability rating, but because of the high importance of this BMP for protection of both soil and water values, some will be performed anyway.

BMP ((1G)) -- Prevention of concentrated road runoff from causing peakflow increases when buffer corridor is too narrow.

Description:

When road is in zone where it is closer to the streamcourse than the buffer corridor distance specified by BMP 1F, catch and store all concentrated runoff produced by surface crossdrains and/or flow splitters. This BMP can be implemented by any of the following or similar techniques:

- Construction of runoff catch basins below crossdrain outlets. These usually will be made from soil and be a combination of a below ground pit and an above ground berm. They will be large enough to catch/hold all of one storm's runoff. [ft3 volume of catchment = (0.063 ft) x (horizontal width of road bearing surface plus cut, ft) x (distance to next upgrade crossdrain, ft). 0.063 ft is the depth of a 10 year/30 minute rainfall.]

- Construction of a lead-back ditch/berm at bottom of fill during pioneering phase that leads runoff back away from the streamcourse -- ditch/berm will have partial ditch relief exits every 30 feet and total ditch/berm will extend out along edge of fill for 90 to 115 feet from streamcourse edge. The 30 foot runoff exit points will provide for dissipation of road runoff. The small volume being emitted at each point will be low enough to be completely absorbed into even just a few tens of feet of ground. This technique can only be used on low gradient roads if the lead-back ditch/berm is to placed at the margin of the fill slope -- otherwise it would have to be constructed on ground away from the fill.

- For a road that is to cross a streamcourse, construction of an insloped road that will lead road runoff to an inside ditch. The ditch in turn will have a runoff catch basin at its end near streamcourse that will be large enough to catch all road runoff. Surface crossdrains will lead to inside ditch and the insloped road section will extend out at least until road is 165 feet away from a streamcourse. This method may be the most expeditious for use with existing roads.

- For a road that downgrades to a streamcourse crossing and then continues downgrade on the other side, install berms that will carry concentrated runoff down to area where buffer corridor is again adequate.

- In first-order Class IV streamcourses (only these), construct a runoff retention basin within streamcourse immediately below crossing culvert. Collect and direct road runoff to this retention basin. Collect all running surface runoff that is produced between the last crossdrain that had an adequate buffer corridor and the crossing point. Direct runoff to the retention basin with the use of inside ditches and/or berms. Design volume of basin as described in first technique above. Basin must have significant rock to prevent wash-out, or be constructed with a log(s) that is keyed into bank and is lined with impervious cloth. Basin should not be removed when road is closed unless it is judged to have become unstable. A first-order streamcourse map is supplied to road construction engineers.

Objective: Self-explanatory in BMP title and description.

Responsibility: Design engineers, and Forest Service Contracting Officer Representative or Engineering Representative for implementation aspects.

Reliability: Good, based on a judgement that the objective will be met more than 90 percent of the time.

Monitoring: A Soil and Water Monitoring Plan will be presented in the Final EIS.

Preventing riparian area stream-shade decrease and water temperature increase --

BMP ((2A)) -- Buffer for perennial streamcourses.

Description:

Other than possibly some trees removed for trail safety, no trees shall be harvested for sale purposes within the Streamside Management Unit (SMU) of mapped Class I, II or III perennial streams -- the SMU on these streams extends 200 feet slope distance on either side of the streambank.

Objective: Vegetative shade adjacent to perennial streams that measurably affects water temperatures shall not be removed.

Responsibility: Timber sale operator through supervision and ultimate responsibility of the Forest Service timber sale administrator.

Reliability: Excellent, based on >90% effectiveness and irrefutable logic.

Monitoring: A Soil and Water Monitoring Plan will be presented in the Final EIS. Monitoring other than the Implementation type is not required due to the Excellent reliability rating, but because of the high importance of this BMP for protection of both riparian and water values, some will be performed anyway. This will involve validation testing of the Brown temperature prediction equation and the way it was used for the EIS analysis.

Minimizing Disruption of Class IV Streamcourse Streamside Management Unit (SMU) Which in Turn Minimizes Effects on Sediment, Turbidity and Streamcourse Stability -- (Class I, II, and III SMUs are already protected by BMP 2A above, and also no roads are planned that will cross or be within the SMU of these streams.)

BMP ((3A)) -- Streamcourse designation.

Description:

All Class IV streamcourses (as well as I, II, and IIIs) shall be designated on project implementation maps as requiring the protection of contract provision B6.5.

- A work map will be supplied to Forest Service timber sale designers and lay-out crews.

Objective: Provide a tool for sale contract administrator for communicating with sale purchaser regarding the standard contract provision B6.5 and others.

Responsibility: Responsibility for producing the timber sale Contract Sale Map lies with sale designer. Responsibility for implementation of B6.5 and other provisions lies with the timber sale operator through supervision and ultimate responsibility of the Forest Service timber sale administrator.

Monitoring: Implementation type although the monitoring will also incorporate the achievement of the B6.5 provision.

BMP ((3B)) -- Felling or pulling trees across streamcourses.

Description:

For streamcourses when full suspension yarding is not being used, trees should be felled so that they don't fall over the streamcourse, except those that would be difficult or unsafe to fell any other way. Cable-pulling trees across streamcourses to a point on the other side is allowed if this will cause no more than 5 percent streambank or bottom disturbance, averaged over the length of stream within the subdivision.

Objective: This BMP minimizes disruption of channel inorganic material (to 5%) that in turn can become sediment and turbidity increases. The reason for allowing some disturbance on a Class IV stream is that:

(a) the log yarding economic cost of complete non-disturbance is too high,

(b) the small amounts of sediment to be produced has been shown in the Environmental Consequences section of Fisheries to not be significant in further adversely impacting the Fish Beneficial Use,

(c) Oregon through its Forest Practices Act and Rules allows cable yarding across their Class II designated streams (comparable to Forest Class IV) and allows for minimal amounts of soil entering waters as long as fish habitat is protected.

Responsibility: Timber sale operator through supervision and ultimate responsibility of the Forest Service timber sale administrator.

Reliability: The reliability of the assertion that 5% channel disturbance is an amount that will not result in an adverse effect on the Fish Beneficial Use is rated Excellent based on the EIS analysis. The reliability of the assertion that 5% disturbance is a "minimal" amount (should it be 2%, 10%, etc.) is rated Fair because judgement is used to derive a 75 to 90% effectiveness class.

Monitoring: A Soil and Water Monitoring Plan will be presented in the Final EIS.

BMP ((3C)) -- Streamcourse logging debris clean-out.

Description:

Any logging debris that gets into a streamcourse shall be removed within 48 hours.

Objective: Eliminate the chance of logging slash later being picked-up and floated to places where it might dam-up and later fail, releasing torrents of water that cause abnormal channel cutting.

Responsibility: Timber sale operator through supervision and ultimate responsibility of the Forest Service timber sale administrator.

Reliability: Excellent based on greater than 90% effectiveness and irrefutable logic.

Monitoring: Implementation type.

BMP ((3D)) -- Existing large woody debris in streamcourses.

Description:

Within streamcourses, fallen trees which are partially incorporated into the channel by having trapped stream sediment shall not be removed. Also do not remove the ends of these logs that are resting upon the streambank top.

Objective: Maintain the natural stream dynamics which have been developed, at least partially, in response to natural accumulations of embedded logs. This natural debris produces pools, provides aquatic animal habitat, catches some sediment, and reduces, on the whole, disruptive channel cutting.

Responsibility: Timber sale operator through supervision and ultimate responsibility of the Forest Service timber sale administrator.

Reliability: Excellent based on greater than 90% effectiveness and irrefutable logic.

Monitoring: Implementation type.

BMP ((3E)) -- SMU bare soil.

Description:

Within 80 feet of streamcourses the allowable maximum amount of bare soil that can be produced by secondary dragtrails shall be as specified:

Sideslope gradient	(%)	0-4	5-24	25-44	45-46	65+
Maximum bare soil	(%)	20	15	10	7	5

Objective: Prevent sedimentation of streamcourses by limiting soil erosion near them.

Responsibility: Timber sale operator through supervision and ultimate responsibility of the Forest Service timber sale administrator.

Reliability: Good because judgement is used to derive a greater than 90% effectiveness class.

Monitoring: A Soil and Water Monitoring Plan will be presented in the Final EIS.

BMP ((3F)) -- Crossdrains on secondary dragtrails within SMUs.

Description:

Within 80 feet of streamcourses, hand-constructed crossdrains shall be installed on secondary dragtrails according to the spacing guide specified in BMP 4A. The installation shall be within 24 hours of the establishment of the secondary dragtrail.

See BMP 4A for rest of discussion.

BMP ((3G)) -- Limited structural strength road surface.

Description:

At least within 300 feet of streamcourses, all roads that have limited structural strength shall not be used by Purchaser when "damage" occurs. Following is the watershed definition of "contributing to damage of streams" for use in administering contract provisions, such as C5.124.

- A road condition that results in muddy road surface runoff reaching a streamcourse.
- Allowing road use that renders surface crossdrains ineffective for leading runoff to the side of the road.

Objective: The reason for this BMP is to provide for an easily timber sale contract implementable safeguard that provides for cessation of road activity if one of the other road BMPs is not working effectively or was not implemented (human error). When its implementation is required it will prevent further possibly adverse sedimentation and turbidity.

Responsibility: Timber sale operator through supervision and ultimate responsibility of the Forest Service timber sale administrator.

Reliability: Reliability of the BMP is rated Excellent. Reliability of its being implemented in time is rate Good.

Monitoring: Implementation type.

Minimizing soil erosion increases which affect sedimentation and turbidity-

BMP ((4A)) -- Ground based skidtrail location.

Description: Whenever possible, locate skidtrail 20 degrees or more off of a straight downhill downgrade line and in pre-approved locations

Objective: To reduce overland flow on skidtrails by reducing the grade of the trail.

Responsibility: Contract administration through C6.42 and C6.43 (opt 3) use of preapproved, designated skidtrails.

Reliability: Good, based on current contract administration and compliance.

Monitoring: Implementation monitoring.

BMP ((4B)) -- Crossdrains on skidtrails outside of SMUs.

Description: Crossdrains on ground-based skidtrails in areas where BMP 1A does not apply shall be spaced according to:

Slope Gradient (%)	Crossdrain Interval (slope distance, feet)
3 - 19	110
20 - 39	60
40 plus	35

Objective: To minimize soil erosion and protect water quality.

Responsibility: Contract administration through provisions B6.5, B6.65 and B6.64.

Reliability: Excellent, based on current contract compliance and administration.

Monitoring: Implementation monitoring.

BMP ((4C)) -- Crossdrains on secondary dragtrails outside of SMUs.

Description: Crossdrains as specified in BMP 4B shall be installed within 24 hours after yarding operations related to each landing are substantially completed.

Objective: To ensure timely and effective installation of erosion control structures to minimize erosion and water quality impacts.

Responsibility: Sale administration.

Reliability: Good, based on contract administration and compliance.

Monitoring: Implementation monitoring

BMP ((4D)) -- Maintenance of roads to minimize erosion and sedimentation.

Description: As a minimum measure, all travelled roads will be maintained to protect drainage facilities and maintain existing runoff patterns.

Objective: To minimize erosion and protect water quality.

Responsibility: Administration is through contract provisions C5.42 and C5.43.

Reliability: Good, based on current contract requirements and compliance.

Monitoring: Implementation monitoring

BMP ((4E)) -- Control of traffic during wet periods.

Description: Roads that must be used during wet periods will have a stable surface and sufficient drainage to allow for such use with a minimum resource impact.

Objective: To protect the road resource, minimize erosion and water quality impacts.

Responsibility: Administration is through contract provisions C5.232# - Critical Construction areas, and C5.124 (OPT1).

Reliability: Good, based on current contract requirements and compliance.

Monitoring: Implementation monitoring.

BMP ((4F)) -- Snow removal will be conducted in a manner to protect roads and adjacent resources.

Description: Snow berms should be removed or placed to avoid accumulation of melt water on the road and to prevent water concentration on the road or erosive sideslopes or soils. Roads will be properly shaped prior to winter freeze-up to avoid trapping melt waters in road ruts.

Objective: Protection of the road resource, minimize on- and off-site erosion and maintenance of water quality.

Responsibility: Administration is through C5.43.

Reliability: Good, with current contract requirements, administration and inspections.

Monitoring: Implementation monitoring.

BMP ((4G)) -- Effectiveness of erosion control measures will be determined prior to sale closure.

Description: All erosion control measures will be implemented and approved prior to sale closure.

Objective: To insure that required erosion control measures are implemented properly prior to sale closure.

Responsibility: Contract administration-B6.6.

Reliability: Good, with current contract administration requirements and inspections.

Monitoring: Implementation monitoring.

BMP ((4H)) -- A vegetative cover will be established on skid roads, landings, temporary roads, and all newly constructed roads.

Description: Appropriate measures include seeding of grasses or other vegetation, mulching, and fertilization. This requirement is in addition to the structural measures described above.

Objective: To establish ground cover as soon as possible following activities to minimize erosion and water quality impacts.

Responsibility: Contract preparation-erosion control mix required on disturbed ground and through contract administration.

Reliability: Excellent. This is a standardized contract requirement. Excellent compliance record.

Monitoring: Implementation monitoring

BMP ((4I)) -- Erosion control plans will be required.

Description: The above approved erosion control management practices will be incorporated into engineering design and road and timber sale contract documents to facilitate contract administration.

Objective: To ensure that adequate and proper erosion control measures are implemented on designated areas.

Responsibility: Timber sale administration is through CT.311 - Plan of Operation, and C5.43 and C6.6#.

Reliability: Good, due to contract administration and compliance.

Monitoring: None

Sale Design and Logging Systems Management Practices.

BMP ((5A)) -- Log landings will be located to minimize creation of hazardous watershed conditions.

Description: The cleared or excavated size of landings shall not exceed that needed for safe and efficient yarding and loading operations.

Objective: Landing locations will be selected on the basis of the least amount of excavation and erosion potential, where sidecast will neither enter drainages nor damage other sensitive areas.

Responsibility: Contract administration through C6.4 (opt.3).

Reliability: Excellent. This is a standard practice that is enforced through contract administration.

Monitoring: Implementation monitoring

BMP ((5B)) -- Ground skidding design, falling to lead and end lining.

Description: Ground based skidding equipment will be controlled to limit on-site disturbance and buildup of destructive runoff. This will require appropriate skid trail spacing, falling to lead and end lining of logs. Off-trail skidding will be prohibited.

Objective: Long term soil productivity protection

Responsibility: Through contract provisions: C6.4 (opt.1), C6.4 (opt. 3), B6.5 and C6.3.

Reliability: Good. This is a standard contract requirement.

Monitoring: Implementation monitoring.

BMP ((5C)) -- Full or partial suspension log yarding will be required where designated on sale area maps.

Description: Suspension requirements will be based on site specific erosion hazard potentials.

Objective: Minimize erosion and water quality impacts.

Responsibility: Contract administration through: B6.5, B6.65, C6.3 opt.1), C6.3 (opt.2), C6.42# and C6.43.

Reliability: Good. Contract administration will insure compliance.

Monitoring: Implementation monitoring

BMP ((5D)) -- To allow for greater harvest flexibility, log-skidding off designated trails will be allowed when there is 2 feet or more of snow or when the ground is frozen to a depth of 4 inches or more. Harvest operations will be monitored closely. If the harvest equipment is not supported by the snow or frozen ground, operations will be moved to a pre-approved pattern and spacing as designated in the timber sale contract.

Description: As above.

Objective: Minimize ground disturbance and soil compaction.

Responsibility: Contract administration through provisions: C6.46 (opt.1), C6 46(opt.2).

Reliability: Good. This is a standard practice that has been administered successfully on the Forest.

Monitoring: On-going during the life of the project.

BMP ((5E)) -- Equipment shall not be operated when conditions are such that soil and or water damage will result.

Description: Self explanatory

Objective: Prevent resource impacts.

Responsibility: Contract provisions B6.6 and B6.65 must be met. The kinds and intensity of erosion control work done by the purchaser shall be adjusted by the ground and weather conditions and the need for controlling runoff. Erosion control work shall be kept current.

Reliability: Good. Standard contract administration requirement.

Monitoring: Implementation monitoring: on going.

BMP ((5F)) -- Erosion control on skid trails.

Description: Waterbars on skidroads, tractor roads and secondary trails will be required where slope gradients exceed 3 percent.

Spacing (feet) by Slope Gradient

Gradient	Spacing
3-19 percent	110
10-39 percent	40
40 percent +	25

Objective: Minimize erosion and water quality impacts.

Responsibility: Administration is through contract provisions B6.5, B6.65 and B6.64.

Reliability: Good. Standard contract administration requirement with good compliance record.

Monitoring: Implementation monitoring

BMP ((5G)) -- Follow-up inspections of erosion control structures will be required until soils are stabilized. Inspections will indicate whether or not the area is handling water properly. If deficiencies are found immediate corrective action will be taken.

Description: As above

Objective: As above

Responsibility: Appropriate District personnel.

Reliability: Good, with periodic inspections.

Monitoring: On going.

BMP ((5H)) -- All landings, tractor skid roads and all temporary roads will be tilled through the depth of compaction. Winged subsoilers will be used for all soil rehabilitation projects involving amelioration of soil compaction.

Description: As above.

Objective: To maintain soil productivity by restoring soil properties to pre-impact conditions.

Responsibility: Administration is through contract provision C6.4 (OPT.3).

Reliability: Good to excellent since this is a standard operating practice on the Wallowa-Whitman National Forest.

Monitoring: Implementation monitoring.

Minimizing riparian area shrub damage by livestock

For this set of BMPs (6A through 6C), this is a consolidated discussion.

Objective: Minimize riparian area shrub damage by livestock by limiting browsing to the amounts specified in the BMPs. This will allow for maximum rates of riparian shrub increase, whether the shrubs are planted or re-establish naturally.

Responsibility: National Recreation Area (NRA) grazing managers.

Reliability: Conceptually, BMP 6B is the over-riding BMP. 6A can be thought of as just a guide to a probably acceptable level of grazing pressure -- if it doesn't work-out, the most important 6B is still there to fall-back on. The reliability of 6B is rated Excellent base on greater than 90% effectiveness and irrefutable logic. The reliability of BMP 6A is rated Fair based on 75 to 90% effectiveness and judgement. BMP 6C is just administrative direction (Excellent).

Monitoring: BMP 6A and 6B themselves are specifications for monitoring which will be carried out by NRA grazing managers with consultation provided by Forest headquarters staff.

BMP ((6A)) -- Riparian shrub browsing by livestock.

Within riparian management zone (RMZ), livestock grazing shall be discontinued for the year if more than 50 percent of the current year's accessible (< 4.5 feet tall), shrub leader growth has been removed (by any ungulate). This shall be assessed within key areas determined in coordination with NRA grazing managers. Livestock grazing may occur within the RMZ the following year if BMP 6B is also being achieved.

- Shrubs are defined as riparian shrubs and any shrubs that have been planted. Riparian shrubs are those that require soils that are very wet (have free or unbound water) for much of the year such as willow, alder, aspen and cottonwood. The RMZ is defined for the Tepee Butte areas as the zone bounded by the edge of the floodplain adjacent to Class I, II and III streamcourses but not to exceed 100 feet. Where there is no obvious floodplain, assign a distance of 25 feet. These distances apply to each side of the streambank.

BMP ((6B)) -- Provision for shrub density rate increase.

Within RMZ, livestock grazing shall be discontinued if the rate of shrub density increase is less than 90 percent of the rate of density increase exhibited within livestock excluded areas set up for administering this BMP. Rate of change is determined graphically each year from field data -- the last point on the best-fit, statistically derived line for the grazed area data is compared to the last point on a similar line developed for the density change in the livestock exclusion plot. If the last point on the graph/line for the grazed plot is less than 90 percent of the last line point for the exclusion plot then the BMP objective has not been met. Livestock grazing shall not be reinstated within RMZ until the rate of shrub density increase is again within 90 percent of that within exclosures.

- Livestock exclusion will be implemented by felling dead trees into a jack-strawed pattern that is deep/dense enough to prevent significant access. Density changes shall be determined using the line-intercept or similar method which records percent of the line covered by two categories -- under shrub canopy and not under shrub canopy. Transects will be between permanently established steel stakes.

BMP ((6C)) -- Re-introduction of livestock grazing.

Livestock grazing shall not be re-introduced into RMZs until riparian survival and density test plots are installed as described in Appendix H, Resource Projects.

Management Practice intended for site productivity protection and enhancement.

BMP ((7)) -- A minimum of 15-20 tons/acre of 3 to 9 inch woody material will be left on the ground on each harvest acre. This material includes existing down material, branches and tree tops. In order to meet this requirement some material may need to be felled on site. An additional 10 tons per acre of 14 inch or larger size class material will be left for down/dead woody material requirements.

Description: As above

Objective: Maintenance of soil productivity through organic/woody residue management and erosion prevention.

Responsibility: Sale design and contract administration.

Reliability: Good. Researchers suggest this amount to be left on-site where maintenance of long-term soil/site productivity is the objective.

Monitoring: Implementation Monitoring

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APPENDIX E

ENTOMOLOGY REPORT

ENTOMOLOGY REPORT

TEPEE BUTTE FIRE RECOVERY PROJECT
By
Don Scott, Entomologist
and
Craig Schmitt, Forest Pathologist

INTRODUCTION

This section will describe the prominent insects that are expected to be associated with the Tepee Butte Fire. Other sections (1) discuss forest diseases, (2) discuss several management alternatives and guidelines for dealing with insects and diseases, and (3) examine several case studies of insect activity associated with fires, including the Tillamook Burn.

Management alternatives and guidelines will emphasize primarily Douglas-fir and grand fir. A discussion of insects associated with ponderosa pine, a minor component of the burn, will also be included.

INSECTS

Insects Associated with the Tepee Butte Fire

Bark Beetles

Of all the insects associated with fires, bark beetles (family Scolytidae) are potentially the most destructive and unpredictable. The beetle of primary concern in the Douglas-fir region is the Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. It is the most abundant of the Scolytidae in fire-killed Douglas-fir. Following the Tillamook Fire of 1933 in western Oregon, this beetle rapidly consumed the susceptible fire-injured Douglas-fir and began attacking healthy green trees in adjacent stands, sometimes extending its attacks several miles from the burned area. Extensive tree killings were reported in five Oregon counties as a result of the beetle's expansion from the burn to surrounding areas (Furniss 1936). Estimates place the loss at 200 million board feet during a 3-year period following the fire (Bedard 1950). The beetle prefers to breed in logging slash, windthrow, or fire-scorched trees, and breeds prolifically when an abundance of such material is available (Bedard 1950). Nearby healthy trees are often attacked and group-killed when the beetle has exhausted the supply and suitability of the weakened, dying, or recently dead host. In the more arid portion of the Douglas-fir range east of the Cascades, in the Inland Empire, and in the northern Rocky Mountain region, the Douglas-fir beetle is frequently an aggressive tree killer. Outbreaks of the Douglas-fir beetle in these localities subside slowly (Bedard 1950).

The adult Douglas-fir beetle is a cylindrical and stout, dark brown or black beetle, usually with reddish-brown wing covers, and is about 5-6 mm long. The females burrow into the inner bark and, with the aid of the male, construct a vertical gallery with eggs laid in niches along the gallery length. Eggs are laid in groups, with groups of eggs alternating between each side of the gallery. The eggs hatch into white, legless grubs or larvae with brown heads. When mature the larvae transform into white pupae and emerge as adult beetles. The Douglas-fir beetle has one generation per year and overwinters under the bark as mature larvae or adults. Adult beetles emerge in the spring and attack new hosts between April and early June. Overwintering larvae complete development and emerge to make their attacks in July and August the same year. Douglas-fir beetles kill trees through the girdling action of larval mines and by the introduction of blue-stain fungus spores, *Ophiostoma pseudotsugae* (Rumb.) von Arx (= *Ceratostomella pseudotsugae* Rumbold), which germinate and develop in the conducting tissues of the tree, blocking transpiration. The tree, which dies in a few weeks, does not usually fade until the following season. The fungus can girdle and kill the tree, even when the Douglas-fir beetle fails to develop successful broods (Bedard 1950).

Ambrosia Beetles

Ambrosia beetles also belong to the family Scolytidae. Like their relative the Douglas-fir beetle, they are among the earliest colonizers of Douglas-fir following a fire, often attacking their host in great numbers. However, unlike the Douglas-fir beetle which can breed only in Douglas-fir and occasionally western larch, ambrosia beetles attack true firs, spruce, hemlock, and pines in addition to Douglas-fir and larch. Consequently, sapwood of the relatively large component of grand fir, as well as other species on the Tepee Butte burn, will likely become colonized by these insects. Furniss (1937) credits these beetles with being the first to enter the wood of fire-killed trees in the fall of 1933 following the Tillamook Fire.

The beetles riddle unseasoned wood with tiny round pinholes or shotholes, and introduce fungal spores that cause dark brown or black stains to develop around the boring tunnels. These pinholes and the staining can seriously degrade the quality of valuable logs that would have otherwise produced clear lumber. The nature of impact caused by ambrosia beetles is largely aesthetical, and though holes may be abundant, if the wood is otherwise sound, their presence does not result in total loss of sapwood (Furniss 1937). The cool, moist conditions of coastal forests in western Oregon and Washington favor development of populations of these insects, where they can become quite damaging at times. In the drier areas of the West, however, significant damage has not been attributed to them (Furniss and Carolin 1977). The two species commonly found associated with Douglas-fir are the striped ambrosia beetle, *Trypodendron lineatum* (Olivier) and *Gnathotrichus sulcatus* (Le Conte); of these, the striped ambrosia beetle is the most abundant species in the Northwest (Chamberlin 1958).

Ambrosia beetles are small, cylindrical in shape (the striped ambrosia beetle is the more stout and robust), dark-reddish brown or black in color, and 3-4 mm long. The adults construct mines in the sapwood which support fungus gardens for their food supply. Larvae are reared in short mines or "cradles" off the main galleries, where they will remain until becoming adults. Ambrosia beetles will attack dying or recently felled or windthrown trees, fire-injured or fire-killed trees, stumps, tops, and larger slash. Evidence of attack is the accumulation of white sawdust in cracks and crevices on the bark, in tiny mounds around the base of trees and stumps, or under logs.

Bark beetles associated with fire-killed or fire-injured ponderosa pine are western pine beetle, *Dendroctonus brevicomis*, mountain pine beetle, *D. ponderosae* Hopk., red turpentine beetle, *D. valens* LeConte, *Ips* engraver beetles (*Ips pini* [Say], *Ips emarginatus* [LeConte]), and "sour-sap" beetles, *Hylurgops porosus* (LeConte) and other *Hylurgops* beetles. These beetles will attack both fire-killed and fire-weakened trees but brood production is often poor or unsuccessful in fire-killed trees when moisture conditions in the inner bark result in sour sap. *Hylurgops* beetles can survive in this condition, but these beetles do little damage to the tree and pose no threat to living trees. Their habits are generally similar to those described for the Douglas-fir beetle in terms of breeding in recent dead or weakened trees and logging debris and slash; however, only the western pine beetle, mountain pine beetle, and engraver beetles are capable of outbreaks of tree-killing proportions.

The western pine beetle is the insect of major concern on fires in pine types. This beetle is almost always associated with pines injured by fire, and to a lesser extent with those killed by a fire. They prefer to attack trees in which the crown has been scorched, yet not injured enough to kill the tree. Miller and Keen (1960) found that trees killed immediately because fire burned all foliage, charred the bark, and killed the entire phloem area, were not attractive to western pine beetle. Instead, they selected trees which survived fire with enough green phloem and live buds to permit new needle growth. Defoliation of the crown by fire can result in reduced growth of the fire-injured tree. This growth suppression is the dominant factor relating fire injury to western pine beetle attack during the first few years after a fire (Miller and Keen 1960). It is likely that over the next 2 or 3 years, western pine beetle will inflict heavy mortality to the fire-injured and weakened ponderosa pine in the project area.

Mountain pine beetles and red turpentine beetles are attracted to fire-injured trees soon after a fire (Miller and Keen 1960). An inspection of the Tepee Butte Fire area on November 7, 1988 (ref. 3420 letter to Hells Canyon NRA dated December 12, 1988) revealed very little insect activity on fire-injured or fire-killed timber. Red turpentine beetles were found in the base of a few ponderosa pine, but because of the late season timing of the fire, most insect flight was over and beetle attacks will not begin again until June. Mountain pine beetle is capable of devastating epidemics in overstocked lodgepole and ponderosa pine stands, but breeds poorly in logging slash and fire-injured trees (Mitchell and Sartwell 1974). The mountain pine beetle will probably not contribute significantly to mortality of ponderosa pine damaged by the fire or pose any threat to nearby undamaged pines. The pine that burned in the fire is a minor component of burned area (i.e. approximately 20 percent), and consequently will not be a significant factor in the dynamics of insect populations on the burn. Also, because they are less often directly associated with fire-damaged trees and breed poorly in this material, mountain pine beetles are not expected to occur in any great numbers.

The engraver beetles of the genus *Ips* are common after fires in the pine type. They usually occur in conjunction with mountain pine beetle or western pine beetle and attack trees killed or severely damaged and weakened by fire. In the Northwest, engraver beetles have two generations per year. The overwintering adult populations emerge from the slash where they were reared, or from the duff layer under the slash, and initiate attacks in April and May. They produce a progeny that matures and flies in July and August. This latter generation of beetles kills living trees (Mitchell and Martin 1980), and is responsible for any fall attacks on injured pines that may have occurred immediately following the fire.

Engraver beetle outbreaks in standing trees or unmanaged stands rarely exceed 1 year. However, a continuing supply of fresh slash, windthrows, or fire-scorched trees can produce enough beetles for lethal attacks on uninjured trees to continue for as long as a source of this preferred breeding material is available to support populations. Pine mortality occurring outside the burn area would probably be drought-related, and not attributable to a buildup of pine engraver populations in fire-injured or killed trees.

Woodboring Beetles

Following the Douglas-fir beetle in significance of damage, the next most important phloem feeder associated with recently killed and fire-injured Douglas-fir is the flatheaded fir borer, *Melanophila drummondi* Kirby. Although this insect feeds exclusively in the phloem/cambium interface, it belongs to the family of flatheaded or metallic woodboring beetles (Buprestidae), the majority of which, in its larval stages, bores in the sapwood or heartwood.

The flatheaded fir borer is often found with the Douglas-fir beetle, and aids this bark beetle in killing fire-scorched trees and loosening the bark of fire-killed trees. It usually invades dead or dying trees (Burke 1910; Essig 1958; Keen 1952) but can be very destructive to living trees also (Chamberlin 1924; Doane et al., 1936; Essig 1958; Hopkins 1904). This beetle occasionally causes heavy timber losses when it attacks live trees, often killing the largest and best in the stand (Essig 1958). It is less abundant and causes less deterioration to Douglas-fir than the Douglas-fir beetle.

The beetle prefers sunny exposures over shade, but will initiate attacks in partial shade. It normally limits attacks to the scorched and weakened trees on the edge of the burn, but is much less aggressive than the Douglas-fir beetle in attacking and killing green trees. According to Chamberlin (1924), live trees that are heavily attacked are killed in one or more seasons. On the other hand, if beetle attack is lighter and the trees are growing more vigorously, the larvae are often killed, and the wounds caused by the larval mines heal over.

Although the flatheaded fir borer normally attacks only trees the first season after a fire, if the inner bark dries out slowly, this insect can attack hosts and produce brood the second year following a fire. The flatheaded fir borer is a "generalist" in its feeding habits on conifers. It can produce brood in a wide range of conifers including Douglas-fir, western larch, nobel fir, grand fir, white fir, California red fir, subalpine fir, Pacific silver fir, Engelmann spruce, white spruce, Sitka spruce, western hemlock, and mountain hemlock (Barr 1971). It has also been reported in ponderosa pine (Scott 1974), lodgepole pine (Hardy 1948), and deodar cedar (Nelson and Westcott 1976). Douglas-fir and grand fir injured by the project fire may likely be attacked by this beetle.

Larvae of the flatheaded fir borer are very distinctive in appearance, as are the larval mines. The head of the larva is enlarged and greatly flattened, and tapers abruptly at the rear to a thin segmented body. The overall length of late instar larvae is approximately 25 mm. The flatheaded fir borer flies from May through September (Burke 1919; Essig 1958), although flight can occur as early as March depending on rate of larval development and spring ambient air temperatures (Scott 1978). Eggs are deposited in crevices of the bark and beneath bark scales. The hatching larvae bore into the bark to the phloem-cambium region where they remain until maturity.

The larvae construct a slowly-widening, tortuous feeding gallery, tightly packing it with frass and boring dust behind it as it advances. Flatheaded fir borers overwinter as prepupae in a "U-shaped" position in pupal cells cut in the outer bark, usually near the surface. Pupation begins around February. Immature larvae hatching from eggs laid during the late summer overwinter in the inner bark, but do not mature to the adult stage until they have passed a second winter as prepupae in the outer bark (Scott 1978). The flatheaded fir borer has one generation per year.

Larvae that attack apparently healthy trees grow more slowly than normal and take longer to reach maturity (Anderson 1966). Natural resistance mechanisms in living trees may be responsible for delayed development of larvae that attack these trees. Anderson (1966) indicates that maturity of larvae developing in growing trees is not reached until all radial growth of the tree has ceased. These insects are able to readily kill fire-injured trees, but apparently have some difficulty overcoming the resistance of undamaged vigorously growing trees. Working in concert with the Douglas-fir beetle, however, they will likely kill several healthy trees on the edges of the burn over the course of the next 2 to 3 years. Populations will subside after this, with tree mortality returning to pre-fire levels or below.

A host of other woodboring beetles of the families Buprestidae and Cerambycidae, and woodboring wasps of the family Siricidae attack fire-killed trees and are likely to be encountered on the project burn. Although none are tree killers, in combination with decay fungi they can seriously degrade wood exposed to their depradations for more than a few years. In a study of 52 fire-killed Douglas-fir stands ranging in age from 1 to 62 years, Beal et al. (1935) found that deterioration begins the first year through staining of a portion of the sapwood, probably in association with attacks of the Douglas-fir beetle and from penetration of the sapwood by ambrosia beetles. By the third year, the activities of woodboring insects and decay fungi (primarily *Fomitopsis pinicola* [Swartz ex Fr.] Karst. and *Trichaptum abietinum* [Dicks. ex Fr.] Ryv.) have rendered the sapwood unsuitable for use, although the heartwood is still sound. Rot fungi and woodborers attack the fourth year, and with each succeeding year, deterioration worsens as insects and fungi extend their activities within the remaining sound wood. By about the eighth or tenth year, the outer 1-4 inches of heartwood are damaged, and beyond this point any salvage of logs for lumber is impractical.

The number of woodborers that attack fire-killed trees during subsequent years are numerous and diverse in their attack and feeding habits. No attempt will be made to describe any in detail beyond what has already been given. For the purpose of this discussion, a listing of the species that one is most likely to find associated with conifers killed by the fire would probably be sufficient. Ultimately, few of these woodboring beetles and wasps are of little importance in regard to salvaging fire-killed timber because they seldom become abundant enough to damage the wood before fungi have rendered the wood useless for lumber (Kimmey and Furniss 1943). Therefore, any salvage operation being considered for the Tepee Butte Fire should be conducted quickly, while the wood is still sound.

The following woodboring species listed by host tree are mostly secondary insects that are likely to occur on the Tepee Butte Fire. Under most circumstances, they serve to break down the sapwood and heartwood of trees that are dying or already dead.

Douglas-fir

- Buprestidae
    - *Buprestis aurulenta* L.
    - *B. lecontei* Saunders
- Cerambycidae
    - *Monochamus scutellatus oregonesis* LeConte
    - *Asemum striatum* (L.)
    - *Arhopalus productus* (LeConte)
    - *Leptura obliterata* Haldeman
    - *Tetropium velutinum* LeConte
    - *Ergates spiculatus* (LeConte)

Siricidae
- *Xeris* spp.
- *Sirex* spp.
- *Urocerus* spp.

Grand fir

Buprestidae
- *Buprestis aurulenta* L.
- *B. lecontei* Saunders

Cerambycidae
- *Ergates spiculatus* (LeConte)
- *Rhagium inquisitor* (L.)

Siricidae
- *Xeris* spp.

Western larch

Cerambycidae
- *Rhagium inquisitor* (L.)
- *Tetropium velutinum* LeConte
- *Leptura obliterata* Haldeman

Siricidae
- *Xeris* spp.
- *Sirex* spp.
- *Urocerus* spp.

Ponderosa pine

Buprestidae
- *Melanophila gentilis* LeConte
- *M. acuminata* (DeGeer)
- *M. consputa* LeConte

Cerambycidae
- *Monochamus scutellatus* (Say)
- *Rhagium inquisitor* (L.)
- *Ergates spiculatus* (LeConte)
- *Arhopalus asperatus* (LeConte)
- *Acanthocinus princeps* (Walker)

Siricidae
- *Xeris* spp.
- *Sirex* spp.
- *Urocerus* spp.

FOREST DISEASES

Introduction

Tree diseases are a normal part of our forest ecosystems. Losses occur because we have put a value on living, healthy trees as a resource. Types of diseases, as well as degree of impact will change based on plant community, stand history, and successional status. The changes that man has made to natural forest conditions, including the exclusion of fire and certain methods of timber harvesting, have generally resulted in an increase in diseases and disease-caused damage.

Fire can generally be viewed as beneficial in the long term by removing shade-tolerant, disease-susceptible species and reverting the stand to a higher component of seral species. Some short-term adverse impact may occur. Trees that are weakened by fire may be attacked by pests that prefer stressed hosts.

The potential for disease-caused losses in improperly managed stands are much greater in the long term. Silviculture strategies for stands affected by fire need to be carefully selected and ramifications of disease-caused impact must be considered.

Root Diseases

Root diseases are common pests of mixed conifer stands, especially stands with a history of management, particularly partial cutting. Root diseases are particularly damaging since they become part of the site. Inoculum, in the form of infected roots and stumps, will infect subsequent generations of trees.

Annosus root disease, caused by *Fomes annosus*, infects its host in two ways: by depositing airborne spores which germinate on freshly-exposed wood, and by mycelial growth from diseased roots to healthy roots via contacts or grafts. Infection by airborne spores occurs soon after woody tissue (wounds or stump surfaces) is exposed. Conditions for successful colonization are believed to exist most of the year. Even trees cut in the winter may be colonized in the spring following snow melt and thawing. Conditions in mid-July through August may be less-than-favorable due to high temperatures and low humidity.

Infection of freshly-cut stumps by *F. annosus* spores is the most common way that new disease centers develop. Following successful colonization of the stump and roots by the fungus, adjacent trees can be infected as the fungus crosses root contacts and grafts. The average rate of spread in disease centers is about 1.5 feet/year.

Size of stumps infected by *F. annosus* is an important influence on the potential for infection of adjacent trees. Generally, stumps 18" in diameter or larger are most apt to develop into root disease centers.

In northeastern Oregon, grand fir and other true firs (*Abies spp.*) are extremely susceptible to infection/colonization by *F. annosus*, but the fungus does not survive as long as in stumps of susceptible resinous species. Ponderosa pine and Douglas-fir stumps may become infected, but on most sites infection does not spread to adjacent trees. Different strains of the fungus also exist and cross-over between stumps and trees of different species is seldom seen.

Large grand fir stumps can contain viable *F. annosus* decay 30 years after cutting. Evidence of infected regeneration and adjacent residual trees usually appears about 20 to 25 years after cutting.

Potential for damage increases with frequency and intensity of partial cutting in grand fir stands. Most infection will occur in stands where numerous large grand fir are cut and residual grand fir are damaged during harvest activity.

Annosus root disease results in two types of damage to grand fir: tree mortality and wood loss through decay. Mortality is most common in trees infected via root contacts or grafts. Butt decay is more common as a result of tree wounding. Wounded trees that become infected and colonized by *F. annosus*, as well as other decay-causing fungi, will compartmentalize the decay column, resulting in decay being restricted to only the woody tissue present at time of wounding. Frequently, trees infected by *F. annosus* are attacked by secondary pests because of their weakened state. The fir engraver, *Scolytus ventralis*, usually is the direct cause of mortality to root-diseased grand fir. Other root diseases, oftentimes Armillaria root disease caused by *Armillaria ostoyae*, infect trees already having annosus root disease. In general, damage increases with time elapsed since partial-cut entries or other disturbance.

Management recommendations for minimizing annosus root disease in grand fir stands are as follows:

1. Minimize or eliminate intermediate, partial-cut, or salvage entries in stands where grand fir will be managed in the future.

2. Attempt to revert stands to seral ponderosa pine, western larch, and Douglas-fir in appropriate stands where grand fir increased as a stand component due to partial cutting and fire exclusion.

3. In stands where grand fir will be managed in the future, stump treatment to prevent *F. annosus* infection is recommended. Freshly-cut stumps, 18" in diameter and larger, are given a light coating of granular borax (Sodium tetraborate decahydrate) to prevent infection by airborne spores. C-Provision C6.412-(Option 2)-*Treatment of Stumps.* (5/88), can be specified in timber sale contracts to require this treatment be done. The wording of the clause would have to be modified by changing "live trees" to "live and recently-killed trees" in fire-salvage entries.

The effects of fire in mixed conifer stands generally result in killing a much greater proportion of grand fir than associated species. Grand fir is usually killed by heat generated by ground fires (Hall 1982). Stumps of salvaged fire-killed trees may be readily infected by *F. annosus*. Residual, regenerated, and wounded grand fir may be subsequently killed or damaged.

Armillaria root disease is a commonly-occuring cause of damage to Eastern Oregon mixed conifer stands. The conifer most susceptible to damage in northeastern Oregon is grand fir. Other conifers can be damaged but the degree of relative susceptibility varies by locality and stand condition. Where Armillaria is particularly virulent, all associated species may be damaged. Western larch and lodgepole pine will generally have minimal damage, even under catastrophic root disease conditions. Habitat types where the highest incidence and the greatest damage occur are the cool and moist to warm and moist regimes. Disturbed sites having a history of partial-cut entries in association with soil compaction and displacement or wounding of roots and lower boles of residual trees, have higher incidence of Armillaria than similar undisturbed sites. In previously uninfected stands, incidence of Armillaria root disease is known to develop following disturbance. The degree of resulting damage can vary considerably.

The fungus spreads several ways, most commonly through the soil across root contacts or grafts, between infected trees or stumps, and into regeneration or residual susceptible trees. Secondly, it can spread through the soil up to 6 feet via fungal structures called rhizomorphs between infected and healthy roots. Thirdly, it can spread by airborne spores to wounds and freshly-cut stump surfaces. Spore-spread is not well understood and is considered minor compared to vegetative root-to-root spread.

After successful infection of grand fir, mortality may result, particularly in smaller diameter trees. The fir engraver, *Scolytus ventralis*, frequently is the direct cause of death, attacking and killing grand fir weakened by root diseases. Stress-inducing site and abiotic factors including disturbance, drought, and fire will increase incidence and severity of damage.

In harvested stands already infected by Armillaria, *A. ostoyae* inoculum loading will usually increase because stumps and roots of cut trees may be colonized. This can result in excessive infection of regeneration and residual trees in the future. In such situations, these species are exposed to excessive hazard.

Management recommendations to minimize Armillaria root disease in grand fir are as follows:

1. Minimize soil disturbance during intermediate, partial-cut, or salvage entries.

2. Where Armillaria root disease is known to occur, regenerative harvest systems are preferable to salvage or partial-cutting due to anticipated increase in infection and mortality of residual grand fir.

3. Site-adapted seral species should be favored on sites damaged by fire.

Dwarf Mistletoes

Dwarf mistletoes are parasitic higher plants that are generally host-specific. As obligate parasites requiring a living host, they spread by forcibly ejected seeds discharged from mature female plants in the fall and intercepted by foliage of susceptible hosts. The seeds have a sticky coating that causes them to adhere to foliage, yet when they become wet they slide to the base of needles. Seeds then germinate and produce a peg that grows into the host tissue. After several years, mature male or female aerial shoots are formed. Plants obtain photosynthate and water from the host, causing the tree to produce swellings and "brooms" which reduce the vigor of the tree.

Various host/dwarf mistletoe interactions present different management strategies due to effects on the host, ecology of the host, and impact of the parasite.

Douglas-fir dwarf mistletoe (*Arceuthobium douglasii*) is a common pest in the Tepee Butte Project area. Damage to infected trees results in reduction of wood grade and quality, seed/cone production, and vigor, thus increasing susceptibility to attack by other pests. Also there is loss of management opportunities of the understory, and greatly increased mortality.

Understory trees around infected overstory trees are probably severely infected even if not noticeable. Upon releasing the understory by removing the overwood, dwarf mistletoe infections are soon fully manifested. Infected trees will not show appreciable growth after 15 to 20 years and will eventually die.

Douglas-fir infected with dwarf mistletoe cannot be managed successfully in multi-storied stands. Such stands need to be sanitized by removing all infected trees to prevent infection of regeneration. Seed tree and shelterwood harvests can be successful if residual trees are only lightly to moderately infected and they are promptly removed when regeneration is established.

Fire has almost no direct selective action on dwarf mistletoe. Indirect relationships concerning fire's effect on hosts, and the effect on the distribution and frequency of mistletoes are considerable (Wicker and Leaphart 1974). Douglas-fir stands infected with *A. douglasii*, are usually susceptible to increased damage from wildfires. Accumulations of dead, fallen brooms around the bases of trees not only contribute to the fuel load around those trees, but can serve as a fuel ladder to the crown. Large brooms on infected Douglas-fir can also contribute to the vertical distribution of fuels to support crown fires (Wicker and Leaphart, 1974).

Larch dwarf mistletoe (*A. laricis*), affects its host similarly to other dwarf mistletoes. It is especially damaging because it eventually causes the crown to deteriorate, causing loss of seed production, height and diameter growth, and eventually death. Infected understory trees may be regenerated if they are released before infection becomes severe. As long as the top one-third of the crown remains free of infection, trees may be successfully managed. Because of its shade intolerance, larch generally does not regenerate without disturbance (fire or logging). When it does it should be managed because of the species' value and resistance to stem decays and root diseases.

Silvicultural treatments of dwarf mistletoe-infected stands following fire will determine the degree of infection and subsequent impacts that would later develop. Surviving infected individuals can serve as sources of infection for regeneration that would become established in stands following the reduction in stocking. There is an opportunity to sanitize stands by removing infected survivors, especially where susceptible regeneration is anticipated. Lightly- to moderately-infected trees can be retained for seed if they are removed or destroyed upon establishment of regeneration.

Stem Decay

Grand fir is extremely susceptible to stem decay. Indian paint fungus (*Echinodontium tinctorium*) causes a red-brown, stringy heart rot that can extensively damage stands. Affected trees are often culled. Indian paint fungus causes approximately 80 percent of the decay in old-growth grand fir in the Blue Mountains. Cull rates can exceed 40 percent of gross board foot volume on a stand basis (Aho 1966; Aho 1977). Management of grand fir advance regeneration is not recommended when it has been suppressed for 50 or more years. Such trees are probably already infected with Indian paint fungus and susceptible to decay. This is best illustrated by discussing the biology of the fungus.

The sporophore or conk of Indian paint fungus is a common indicator of cull/infection on grand fir. They occur singly or in groups on the boles of infected and decayed trees. Viable spores are produced by conks throughout the year (Etheridge and Craig 1976; Maloy 1967). Optimal conditions for sporulation and germination occur in the spring and fall when temperatures periodically fall below 40 degrees F and mean daily temperatures are between 40 and 65 degrees F (Filip et al 1983). Spores of the fungus infect small (less than 2mm diameter) exposed branchlet stubs (Etheridge and Craig 1976). A minimum of 40 years is required for formation of branchlet stubs. Slow-growing suppressed trees have numerous slow-healing stub surfaces that may become infected by spores of Indian paint fungus. After the stub is overgrown, the fungus enters a dormant state and can survive 50 or more years without causing decay. Dormant infections can be activated immediately when the tree is wounded (logging wounds, frost cracks, fir engraver attacks, etc.), allowing air to enter the trunk interior (Filip et al, 1983).

Most suppressed trees have numerous dormant infections; wounds can trigger decay at several points. After extensive decay has developed, conks are formed. Decay is most common in grand fir under the following conditions:

- in trees suppressed a long time before release
- in trees wounded frequently
- in trees growing on northerly aspects
- in trees growing on lower slopes
- in stands where overstories were grand fir/Douglas-fir as opposed to ponderosa pine
- in older stands

MANAGEMENT RECOMMENDATIONS AND GUIDELINES FOR INSECTS AND DISEASES

Recommendations have already been made in the foregoing as to where salvage operations should or should not be conducted, when salvage is considered (i.e. do not salvage in Dispersed Recreation/Native Vegetation allotments; salvage only in those designations where timber management activities are permitted by the CMP). Guidelines on what to cut and what to leave will be developed later. Consideration of regeneration activities on the burned area will be made in reference to pest management concerns. The following will address these issues first.

Regenerating the area burned in the project fire can have major pest management implications to regeneration and subsequent stands that develop. The opportunity is at hand to prescribe sound silvicultural practices that will minimize the potential for insect and disease damage in the future stands. By following the recommendations, a healthy pest-resistent stand can be developed and maintained to rotation while fulfilling Comprehensive Management Plan directives for other amenities, values, and benefits.

Occurrence and impact of insects and diseases can be exacerbated by disturbances such as fire or by man-caused harvest activities. Specifically, those silvicultural activities that perpetuate shade-tolerant species as opposed to allowing regeneration of seral species allow increases in pest-caused losses in both the short- and the long-term. Western spruce budworm, *Choristoneura occidentalis* Freeman, Douglas-fir tussock moth, *Orgyia pseudotsugata* (McDunnough), several root diseases, and dwarf mistletoes are all serious pests of the climax type. Their activities in these stands can be very damaging and can result in severe defoliation, growth loss, top-kill, reduced seed production, culling, degradation, and tree mortality. Although these pests may not always kill trees, they weaken them, predisposing the tree to attack by bark beetles and woodborers. Reductions in growth and yield from these pests can be significant over a rotation period.

Although individual tree selection silvicultural treatment is among those specified as being permitted in the CMP for Dispersed Recreation/Native Vegetation, this treatment is least desirable with respect to forest health. Silvicultural systems that tend to perpetuate seral species will minimize pest-caused damage. Uneven-aged management, considered on a large scale, includes group selection harvests. This silvicultural treatment uses small regeneration harvests, varying in size from one-half to two acres, to allow establishment of shade intolerant species. The establishment of seral species, oftentimes declining in these stands, would enhance species diversity, a priority objective of any management activity. A group selection silvicultural treatment is permitted by the CMP and should be used to treat stands severely impacted by pests or deemed potentially susceptible to unacceptable damage. Where possible, true fir, Douglas-fir, and spruce should not comprise more than about 30 percent of the stands. Stocking control in pine-regenerated stands will be important in the future to insure low risk from mountain pine beetle.

Uninjured trees and lightly or moderately injured trees with good chances for survival and seed production should not be harvested, especially the ponderosa pine, since they serve as seed sources to help regenerate the burn. Once seedlings become established, the seed trees can be removed if desired. Trees should be evaluated for dwarf mistletoe and, if found, should be removed before regeneration reaches 3-feet tall or 10 years old.

Ponderosa pine with less than 50 percent crown defoliation recover their normal growth within three years, while trees with more than 80 percent defoliation take about nine years to recover (Miller and Keen 1960). Pines with depressed growth are candidates for beetle attacks in future years. Larger trees and trees with greater proportion of crown-injury should be selected for salvage since they are the most attractive to bark beetles. Trees 100 percent defoliated with most of the buds killed will die regardless of whether they are injured further by insects; these trees should be removed (Salman 1934). Since trees that have been killed outright by the fire are not as attractive to beetles as those still alive, removal of the fire-killed trees can be deferred so that higher priority trees can be salvaged when time is a limiting factor in accomplishing the operation. Salman (1934) suggests that it would be prudent to salvage ponderosa pine in the following classes, as the chances are greater they will succumb to insect attack:

1. Trees having more than 50 percent defoliation and moderate to heavy cambium injury, and

2. Trees having 75 to 100 percent foliage injury and none to slight cambium injury.

Crown injury expressed as a percentage of defoliation has been adopted by nearly all scientists studying the susceptibility of fire-injured trees to bark beetles as a measure of potential bark beetle attack. This measurement is easy to obtain and is more or less correlated with cambium injury, depending on the type of fire (Furniss 1965). Recommendations for cutting of fire-injured Douglas-fir to prevent attack by the Douglas-fir beetle have been given by Furniss (1965) as follows:

> Cutting should include first the fire-killed trees to prevent degrade by borers. Next, larger fire-injured trees, which are considered greater producers of bark beetles, and those with 60 percent or more of the crown burned should be cut. To lower the chance of attack to 50 percent or less, trees defoliated 20 percent or more should be removed.

Because of its thin bark and relative susceptibility to cambium damage by fire, any degree of bark scorching on grand fir, regardless of crown condition, should probably be the basis for removal of these trees. As indicated by the evaluation of injury to grand fir on the project fire, even those trees in close proximity to ground fires that had no appearance of injury to the bark were sometimes killed.

Wagener (1961) provides other important factors to consider as well as specific guidelines for estimating the survival of Douglas-fir, ponderosa pine, and other species. Like any of the other recommendations, these are rough guidelines to assist marking crews with the task of identifying for removal trees that are high risk for attack by bark beetles. Each situation must be evaluated as to the merits of leaving a tree as opposed to removing it in view of the relative risk of beetle attack, the survival potential of the tree, the need to provide for natural regeneration of the site, the requirements for wildlife habitat, the potential of the tree for infecting reproduction around it with disease, and other factors.

INSECTS AND FIRE

Fire Case Studies

In the past few years at least two major fires occurred in the Blue Mountains--the Pumpkin Creek Fire in the Hells Canyon NRA and the Joseph Canyon Fires on the Wallowa Valley Ranger District. Both fires occurred within miles of the Tepee Butte Fire in similar forest types. Joseph Canyon fire area was salvaged following the fire but the other was not. The fires occurred simultaneously from lightning strikes during late summer storms. The two fires, with their similarities and differences, afforded a unique opportunity to evaluate current levels of insect activity on or adjacent to the burns two years after the fires occurred. The primary objective was to observe what has occurred entomologically on and adjacent to fire areas under a salvage and no-salvage fire recovery strategy and extrapolate these results for the Tepee Butte Fire. Walk-through evaluations, observations, and professional judgement were used to assess each fire situation.

The final case study will be the Tillamook Fire of 1933. Although this fire occurred in the coastal range of Oregon and represents entirely different climatic conditions than the Blue Mountains, the fire has historic and scientific interest because of the enormous size of the fire, the destruction it caused, and the outbreak of Douglas-fir beetle following the fire.

Tepee Butte Fire

Upwards of 310 million board feet of timber, approximately 80 percent of it Douglas-fir and grand fir and the rest ponderosa pine and smaller components of lodgepole pine and western larch, were burned by the Tepee Butte Fire.

An evaluation of the burn was conducted on November 7, 1988 by an entomologist, pathologist, and silviculturist (ref. Forest Service 3420 letter dated December 12, 1988 to Hells Canyon NRA). Insect activity was noticeably absent during the evaluation. Dozens of trees were examined for insect or disease activity at a half-dozen or more sites located within the southern end of the burn (T4N, R48E) and along the south and southwest boundary of the burn. Of various species examined, only ponderosa pine at one location contained any evidence of attack by insects. The red turpentine beetle, *Dendroctonus valens*, was found working in the base of a few trees at this site. This insect seldom causes tree mortality on its own. It can attack and reproduce in pines without killing them. Repeated attacks can cause weakening of the tree, sometimes killing it, but more often it predisposes trees to attack by other bark beetles. Douglas-fir and grand fir showed no attacks by bark beetles or woodborers, probably because the fire occurred late in the season after insect flight had taken place. A substantial increase in attacks to these fire-injured trees can be expected over the next 2 to 3 years.

Trees killed outright by the fire are characterized as having significant charring of bark and foliage either missing entirely or "frozen" in an upslope position by the intense heat of the fire. These fire-killed trees do not provide good hosts for bark beetles because the sapwood sours making the tree unsuitable for brood development. Woodborers will later enter these trees, but they pose virtually no threat to living trees.

In general, ponderosa pine, larch, and Douglas-fir appeared to fare better than grand fir in surviving the fire. Although the bark of ponderosa pine and Douglas-fir were badly charred in a number of trees, the cambium beneath the bark was still alive and moist. Grand fir, on the other hand, having thin bark by comparison, was more frequently killed because the fire "cooked" the cambium. In one area where a backfire was started, for example, a 16-in dbh grand fir tree escaped any external injury from fire, yet the cambium was found to be brown and dry upon examination. This tree had no charring of the bark and the foliage was green. The radiant heat from the underburn around it apparently dried out the cambium through the thin bark, killing the tree. This tree will fade by next summer. Trees like this are deceptive and are typically passed over by inventory and marking crews during early surveys, resulting in the underestimation of damage from the fire.

It is much too early to tell what impact bark and woodboring beetles will ultimately have on the undamaged Douglas-fir trees adjacent to the fire, but undoubtedly there will be some mortality to both uninjured and injured trees adjacent to the burn over time. The 1988 Aerial Insect Detection Survey conducted by the Forest Service shows increased bark beetle activity in stands adjacent to the burn over 1987 levels, primarily due to the continuing drought. After consideration of all factors and examination of other recent fires under similar conditions in the Blue Mountains, the conclusion reached is that an outbreak population of bark beetles building up in fire-injured timber and moving into surrounding stands to kill uninjured Douglas-fir is not predicted. This conclusion is supported by the fact that the majority of burns investigated show no spread of infestation beyond the burned area (Miller and Keen 1960). An increase in beetle-caused mortality to these adjacent undamaged stands will more likely be due to the effects of the prolonged drought stress on trees, particularly those already weakened by disease or growing on marginal sites. Close follow-up monitoring will be needed to determine the course of insect activity within and adjacent to the burn in the years to come.

Given the direction of the Comprehensive Management Plan (CMP) for the area designated as DR/NV, salvaging in portions of the burn falling within that designation would not be recommended. Considering that fire, insects, and disease play a natural role in modifying the composition and form of forests, the occurrance of these natural phenomena are acceptable processes for the designated area and are consistent with other Hells Canyon NRA values described in the CMP. Present assessment of the situation suggests that insect populations (Douglas-fir beetle in particular) will not build up in the burned-over area and threaten commercial timber lands outside those designated DR/NV. Based on insect activity following other fires (e.g., Pumpkin Creek and Joseph Canyon), however, the probability is high that insects will continue to attack fire-injured trees and a few uninjured trees in the green islands and margins of the burn for the next 2 or 3 years. A fire-initiated outbreak of bark beetles in adjacent unaffected stands does not appear likely. On the other hand, fire-damaged, merchantable timber in other CMP designations where timber management activities are permitted should be harvested to recoup the volume of timber killed or severly injured and likely to die before woodboring insects and decay render the timber useless. It should be emphasized, however, that from an entomological standpoint, any salvage operation that might be conducted on this burn is for the purpose of recovering usable wood fiber and not because beetles colonizing this material pose any real threat to other surrounding commercial stands of timber which were undamaged by the fire.

It would be prudent, in the case of the DR/NV areas burned by the fire, to monitor the insect activity annually over the next 2 or 3 years in order to determine trends of the Douglas-fir beetle and the flatheaded fir borer. These are the major insects that will be attracted to the living Douglas-fir trees (some fire-injured, some not) on the borders of and adjacent to the burn. These two insects are the most destructive beetles to living Douglas-fir trees after a fire and will figure as important factors in post-fire mortality to Douglas-fir. There are no major bark beetles or woodborers that threaten healthy grand fir or larch, and the pine component is so scattered throughout the stands that their bark beetle enemies will be widely dispersed after emergence and will probably not concentrate in any specific area. A few scattered attacks spread over many ponderosa pines will probably not be enough to overcome the natural ability of these trees to resist attacks by pitching out the beetles. Barring any other catastrophic event that would provide an abundance of suitable pine hosts in the near future, western pine beetle, mountain pine beetle, and engraver beetle populations, after increasing on the burn, will return to normal levels within a few years.

Joseph Canyon Fires

The Joseph Canyon Fires occurred on the Wallowa Valley Ranger District, resulting from lightning strikes on August 10, 1986. The fire burned a total of 58,800 acres before containment on August 21. Since numerous fires occurred simultaneously within the Joseph Canyon vicinity, they have been collectively termed the "Joseph Canyon Fires."

Two years after the fire, reports continued to surface about finding active beetle spots at various locations around the perimeter of the burned areas. Tree mortality seemed to be associated with fire-injured trees. The area of activity was focused on Douglas-fir/grand fir type, with mortality limited to Douglas-fir. These trees, weakened from fire injuries, were being attacked and killed by the Douglas-fir beetle. The attacked trees had some degree of charring of the bark that resulted from a ground fire. Adjacent undamaged trees were apparently not attacked. This was consistent with observations from the Pumpkin Creek fire on the Hells Canyon NRA to the southeast (T2N, R48E). The Pumpkin Creek Fire occurred at the same time as the Joseph Canyon Fires.

On November 16, 1988, a walk-through evaluation was made by an entomologist at three locations on the burn (i.e., T2N, R45E, SEC16; T4N, R45E, SEC14/15; and T4N, R45E, SEC9) to investigate insect activity associated with the fire (ref. Forest Service 3420 letter dated December 12, 1988 to Wallowa Valley Ranger District). In all locations, only fire-injured trees appeared to be attacked by bark beetles or woodborers, and relatively few trees seemed to be involved (e.g., estimates place the number of trees attacked at roughly 0.3 trees per acre or less). Undamaged trees on the fire's perimeter did not exhibit any attacks. Insect activity found within the burn or on the perimeter of the burn is summarized in Table 1. The table contains only trees that were found to be attacked or that were damaged by the fire. A general description of the fire damage is given for each tree.

All beetle attacks were in trees that had sustained differing amounts of injury from the fire. The majority of attacks in pines were by a minor bark beetle, *Hylurgops porosus*. Beetles of the genus *Hylurgops* are commonly found in the wet fermenting inner bark at the base of trunks, in the main roots of dying or dead trees, or in freshly cut stumps. The red turpentine beetle, *Dendroctonus valens*, was also fairly common in fire-injured pines. Neither of these insects normally kill trees.

The only insect found attacking Douglas-fir was the flatheaded fir borer, *Melanophila drummondi*. This insect attacks Douglas-fir and numerous other conifers in the spring following a late-season fire. They are typically found in association with the Douglas-fir beetle, but prefer to attack weakend or recently killed trees in openings or partial shade. It is not as aggressive as Douglas-fir beetle, but occasionally will attack and kill green trees.

Numerous live trees with some degree of fire-injury to the trunk or crown had not been attacked by bark beetles or woodborers; a few are included in Table 1. Based on these observations two years after the burn, it appears unlikely that bark beetles in the Joseph Canyon Fires would build up in fire-injured trees and begin attacking uninjured trees in adjacent stands. A few attacks on green trees are to be expected, and some attacks will be successful and kill the tree or strip-kill patches of cambium. An outbreak beyond this year in the uninjured stand, on the otherhand, does not appear likely unless it was drought-, windthrow-, or disease-related, or resulted from some other factor that weakened the tree.

Mortality to fire-injured trees may continue for a few more seasons until the susceptible host material resulting from the fire is depleted or no longer suitable for brood production. Beetles that are attacking fire-injured trees will eventually disperse and move on to other areas to attack weakened trees, and will not likely attack healthy, green trees. The mortality of Douglas-fir and ponderosa pine outside the burn area is related to the prolonged drought and is not due to the buildup of bark beetles within the fire area. The 1988 Aerial Insect Detection Survey shows increased beetle activity throughout the Forest as well as neighboring Forests. The trend in beetle activity has been increasing over the past couple of years because of the drought.

In general, beetle activity appears to be less overall on the Joseph Canyon Fires than on the Pumpkin Creek Fire. This is probably due to the prompt removal of much of the susceptible fire-injured host material during salvage operations following the fires. Removal of fire-injured timber while it is infested or before it becomes infested with bark beetles and woodborers will insure that additional losses due to these insects, both in terms of recoverable volume and additional mortality, are minimized.

Table 1. Insect Damage to Fire-Injured Trees Two Years After the Joseph Canyon Fires

Species	DBH (Inch)	Tree Status	Fire Damage	Type of Fire Damage	1988 Beetle Attack	1987 Beetle Attack	Other Damage	Disease Associated
Ponderosa pine	20	alive (green)	yes	base fire-girdled up to 2 ft.; 25-50% bark circumference scorched up to 12 ft. on leeward side; 40% crown scorch	Dendroctonus ponderosae (unsuccessful - beetles pitched out)	none	none	none
Ponderosa pine	16	alive (green)	yes	base fire-girdled up to 8 in.; 75% bark circumference scorched up to 15 ft. on leeward side; 50% crown scorch	Hylurgops porosus (successful)	none	none	none
Ponderosa pine	10	alive (green)	yes	base fire-girdled up to 6 in.; 33% bark circumference scorched up to 3 ft. on leeward side; no crown scorch	none	none	none	none
Ponderosa pine	12	alive (green)	yes	base fire-girdled up to 8 in.; 33% bark circumference scorched up to 3.5 ft. on leeward side; no crown scorch	none	none	none	none

Ponderosa pine	14	dying (green fading)	yes	base fire-girdled up to 3 ft.; 50% bark circumference scorched up to 20 ft. on leeward side; 50% crown scorch	Melanophila gentilis (successful) H. porosus (successful)	none	none	none
Douglas-fir	20	alive (green)	yes	base fire-girdled up to 1 ft.; 33% bark circumference scorched up to 3 ft. on leeward side; no crown scorch	M. drummondi (unsuccessful - resin infused larval gallery drowning larvae)	none	none	none
Ponderosa pine	13	alive (green)	yes	base fire-girdled up to 18 in.; 66% bark circumference scorched up to 8 ft. on leeward side; 25% crown scorch	D. valens (unsuccessful - resin infused gallery; no brood produced)	none	none	none
Ponderosa pine	22	alive (green)	yes	base fire-girdled up to 6 ft,; 50% bark circumference scorched up to 20 ft. on leeward side; 35% crown scorch	D. valens (successful) H. porosus (successful)	none	none	none
Douglas-fir	22	dying (green fading)	yes	100% of base fire-girdled up to 10 ft.; 40% crown scorch	M. drummondi (successful) Asemum striatum (successful)	none	none	none
Ponderosa pine	30	alive (green)	yes	base fire-girdled up to 1 ft.; 33% bark circumference scorched up to 12 ft. on leeward side; no crown scorch	H. porosus (successful)	none	none	noen
Ponderosa pine	26	alive (green)	yes	base fire-girdled up to 1 ft.; 25% bark circumference scorched up to 5 ft. on leeward side; no crown scorch	none	none	none	none
Douglas-fir	16	alive (green)	yes	base fire-girdled up to 8 in.; 70% bark circumference scorched up to 8 ft. on leeward side; no crown scorch	none	none	none	none
Douglas-fir	23	alive (green)	yes	base fire-girdled up to 6 in.; 30% bark circumference scorched up to 7 ft. on leeward side; no crown scorch	none	none	noen	none

Pumpkin Creek Fire

The Pumpkin Creek fire resulted from a lightning strike August 10, 1986 and burned 14,048 acres before it was fully contained on August 21. The burn occurred within the Hells Canyon NRA in an area designated as DR/NV in the CMP. Timber harvesting operations within DR/NV areas are prohibited by the CMP, except when necessary to control or ameliorate damaging pest problems that threaten adjacent commercial timber resources.

The Hells Canyon NRA chose not to conduct timber salvage operations on the Pumpkin Creek burn. The decision was based largely on recommendations of pest management specialists who evaluated the insect activity on the area and concluded that insect populations developing in fire-damaged trees did not threaten nearby State and private lands and areas planned for commercial timber operations. Pest management specialists have been annually monitoring insect activity on the burn to determine bark and engraver beetle and woodborer trends since the fire's occurrence (ref. Forest Service 3420 letters dated July 9, 1987 and July 21, 1988 to the HCNRA). A summary of monitoring results are given below.

On a visit to several locations within the burned area on June 23, 1987 (ref. 3420 letter dated July 9, 1987), pest management specialists found Ips beetles and mountain pine beetle attacking ponderosa pine, and flat- and round-headed woodborers and Douglas-fir beetle in Douglas-fir. They found these attacks to be light and scattered in trees that were most severely damaged by fire, the majority of which were Douglas-fir. Since undamaged areas and adjacent stands were predominantly Douglas-fir, the Douglas-fir beetle posed the greatest threat to this resource. The pest management specialists could not determine the future trend of bark beetles in these stands from their initial evaluation, so they suggested continued monitoring of the situation and scheduled a follow-up visit in June or July of 1988.

The pest management specialists re-visited the burn on July 6, 1988 (ref. 3420 letter dated July 21, 1988). They found very little insect activity in ponderosa pine; most of the dead Douglas-fir was thought to have resulted from fire damage rather than insect activity. Current attacks by the Douglas-fir beetle were found in scattered pockets over the burn, but as before, the trees being attacked were those with the most severe fire damage. These were usually trees that had lost at least half of their crowns and their boles had been scorched for 10 to 15 feet. The specialists concluded that there was little threat to adjacent commercial timber stands, but that monitoring should continue.

Since the Tepee Butte Fire of Fall 1988 occurred only a short distance North of Pumpkin Creek in a similar vegetation type (i.e. largely Douglas-fir and grand fir), the Pumpkin Creek Fire area afforded an opportunity to observe bark and woodboring beetle activity related to a fire during a natural two-year fire recovery period. The basic assumptions used in comparing fire areas are that both areas are similar in vegetation, climate, site quality, soil moisture conditions, type and degree of fire damage to stands, and other factors that could influence the population dynamics of destructive forest insects following a fire. One difference between the two areas may be the relative levels of insects in stands adjacent to the burns prior to the fires. As mentioned before, the Forest Service's Aerial Insect Detection Survey indicated increased bark beetle activity in the area over the past several years. The drought-related increase may figure into the insect trend following the Tepee Butte Fire.

A walk-through evaluation was conducted on November 8, 1988 by an entomologist, pathologist, and silviculturist. Stands on a north/northwesterly ridge and side slopes of the Horse Creek drainage portion of the Pumpkin Creek Fire were examined for current insect activity. Observations were made on uninjured trees adjacent to the burn, as well as on the fire-injured trees within the burn. These observations are recorded in Table 2. The ridge and upper slopes were on the perimeter of the burn where most of the trees had escaped injury from fire. The stands examined were multistoried, mixed-conifer types consisting mostly of pole-size and mature Douglas-fir with ponderosa pine irregularly interspersed. Pockets of ponderosa pine occurring within the drainage had been attacked and killed by mountain pine beetle or Ips engraver beetles the previous season. The Douglas-fir on the edge of the burn with moderate to severe fire injury had been attacked and killed by

Douglas-fir beetle the previous season or were attacked this year by bark beetles and the flatheaded fir borer and were in the process of fading (see Table 2).

Table 2. Insect Damage to Fire-Injured Trees Two Years After the Pumpkin Creek Fire (continued)

Species	DBH (inch)	Tree Status	Fire Damage	Type of Fire Damage	1988 Beetle Attack	1987 Beetle Attack	Other Damage	Disease Associated
Douglas-fir	21	dead (red-faded)	yes	base fire-girdled; bark scorched to 5 ft. on leeward side; <5% crown scorch	Melanophila drummondi (successful)	Dendroctonus pseudotsugae (successful)	none	none
Douglas-fir	14	dead (red-faded)	yes	base fire-girdled; bark scorched to 6 ft. on leeward side; 5% crown scorch	M. drummondi (successful	D. pseudotsugae (successful)	none	none
Douglas-fir	16	dead (red-faded)	yes	base fire-girdled; bark scorched to 8 ft. on leeward side; 5% crown scorch	M. drummondi (successful)	D. pseudotsugae (successful)	none	none
Douglas-fir	18	alive (green)	no	--	D. pseudotsugae (unsuccessful - resin infused egg gallery; no brood produced)	none	broken top	none
Douglas-fir	20	dead (red-faded)	yes	base fire-girdled; bark scorched to 6 ft. on leeward side; <5% crown scorch	M. drummondi (successful)	D. pseudotsugae (successful)	none	none
Douglas-fir	24	alive (green)	no	--	D. pseudotsugae (unsuccessful - resin infused egg gallery; no brood produced)	none	none	dwarf mistletoe
Douglas-fir	20	Alive (green)	yes	50% of base fire-scorched; bark scorched up to 12 ft. on leward side; 5-10% crown scorch.	D. pseudotsugae (successful strip-attack in area of fire scorch; tree still alive)	none	none	dwarf mistletoe
Douglas-fir	16	alive (green)	yes	50% of base fire-scorched; bark scorched up to 10 ft. on leeward side; small patches of cambium killed.	M. Drummondi (unsuccessful - resin infused larval gallery drowing larvae)	none	none	none
Douglas-fir	19	alive (green)	yes	100% of base fire-scorched up to 20 ft. on leeward side; 5% crown scorch	none	none	none	none

Douglas-fir	24	dying (green fading)	yes	90% of base fire-scorched up to 35 ft. on leeward side; 90-95% crown scordh	D. pseudotsugae (successful) M. drummondi (successful) Asemum striatum (successful)	none	none	none
Douglas-fir	23	dying (green fading)	yes	25% of base fire-scorched up to 1 ft. on leward side; no crown scorch	M. drummondi (successful)	none	none	none

Many of the trees examined showed no evidence of beetle attack. Most of them were uninjured by the fire. Although some had minor bark scorching, these trees were apparently not weakened and consequently not attractive to beetles. Table 2 lists only trees which had been attacked by bark beetles or woodborers. In one case a tree which sustained a moderate amount of fire damage but had not been attacked by beetles was included.

Field observations showed that the attacks by bark beetles and woodborers were still mostly limited to fire-injured trees. Attacks on adjacent non-injured trees, though weakened by dwarf mistletoe and probably the drought of the last few seasons, were unsuccessful. More importantly, there did not appear to be a buildup of either the Douglas-fir beetle or the flatheaded fir borer in uninjured Douglas-fir trees on or adjacent to the perimeter of the burn two years after the fire. This is not to say that green trees wouldn't be attacked and killed. Those within the green islands and on the perimeter of the fire are at highest risk, especially those with any degree of fire injury. Usually insect activity increases for the first 2 or 3 years following a fire. During this period nearly every tree with moderate or severe fire damage could be attacked and killed. A number of trees sustaining light damage, as well as some uninjured trees, may also succumb to beetles. The abundance of fire-damaged trees provides an attractive source of brood material for beetles which are drawn from surrounding stands. Populations that build up in fire-injured trees emerge the following spring to attack other weakened trees. It is common around the edges of large burns like Pumpkin Creek for scorched trees to continue to die following the fire. Some mortality from Douglas-fir beetle and woodborers will probably continue, but gradually decline over the next 2 to 3 years as the weakened, susceptible trees--those which otherwise would have survived injury from the fire--are depleted.

Bark beetles will disperse to new locations once trees associated with the fire are no longer suitable or available to beetles, and mortality will return to normal levels. If the drought continues and is severe, the bark beetles may become more aggressive in their attacks on uninjured trees adjacent to the burn. Based on evidence to date and a synthesis of pertinent scientific literature, increased attacks on nearby undamaged stands are doubtful.

The Tillamook Fire

Up to this point cases have been presented where populations of insects have not increased in the fire area and become damaging to surrounding stands. The Tillamook Fire was one situation where insect populations did build up to outbreak levels and caused an enormous amount of mortality to Douglas-fir in western Oregon before it eventually subsided.

In the aftermath of the fire (1933), Douglas-fir beetles were attracted to the abundant food supply for their young and colonized the fire-injured and killed trees. Exhausting this supply, the beetles began attacking green trees that normally would have resisted attack, eventually killing some 200 million board feet of green timber in the years 1935 and 1936 (Furniss 1941). The epidemic soon subsided, however, due to the natural resistance of green, westside Douglas-fir to the beetle.

Why would the Douglas-fir beetle populations build up to outbreak proportions on a fire like the Tillamook, and begin killing undamaged living trees in surrounding stands, yet not in many other fires that have occurred in California, Oregon, and Washington over the past few years? Furniss (1936) supplies the answer to that question in his following statements:

> While it is unusual to find severe bark beetle damage in the Douglas-fir region of western Oregon and Washington, it is not surprising under the present circumstances. From 1929 to 1933 a yearly succession of large fires in the Tillamook area made available to the Douglas-fir beetle a vast amount of favorable breeding material. As a result, the beetle population increased greatly until the spring of 1935, when it is probable that a majority of the Douglas-firs killed by the Tillamook fire contained beetle broods. In the spring of 1935 countless adult beetles emerged to find very little favorable host material in the form of fire-killed trees. Some of the beetles were absorbed by fire-scorched trees adjacent to the burn; others flew out into the main body of green timber, often many miles from the burn, and attacked groups of healthy trees.
>
> Because it usually does not breed in trees that have been dead more than one year, the enormous supply of breeding material furnished by the fires of 1933 is no longer suitable for its activities. No new material has become available to maintain the abnormally high beetle population, since no large fire has occurred in the Tillamook area in the last two years. Nor does this beetle appear to be capable of maintaining aggressive attacks when its activities are confined to the fast-growing, vigorous Douglas-firs in this region. For these reasons it appears unlikely that the present damage will increase or even maintain its present rate for more than a season or two. The chances are that the present flare-up will drop out of sight by another year.

The notion that high beetle populations must preceed the fire before populations breeding in fire-damaged trees become a threat to surrounding timber was engendered by Hopkins as early as 1909. He wrote:

> It is evident that in some cases fire-scorched and fire-killed timber has contributed to the multiplication of one or more of the insect enemies destructive to living timber, and thus the injury started by the fire may have resulted in a destructive outbreak of beetles. However, it is evident that this has happened only when the destructive beetle was already present in abnormal numbers in the forest surrounding the fire-swept area. Therefore, **it is believed that injuries by fire are not as a rule an important factor in contributing to subsequent depredations by barkbeetles.** (his emphasis)

Conclusions From Fire Case Studies

Based on studies of bark beetle outbreaks that originated from burns reported in the literature, two primary factors appear to be important in determining whether beetle populations will build up in fire areas and begin attacking green stands of timber surrounding the burn. These two factors are: pre-fire beetle populations have to be abnormally high in order to rapidly build up populations in the fire-killed or injured trees (Furniss 1936; Hopkins 1909), and secondly, that brood survival in the fire-injured or killed host must be high in order to produce large populations that can concentrate attacks on green trees (Miller and Keen 1960). Miller and Keen (1960) also state that in studies on three burns, success of brood development was directly related to epidemics of bark beetles that originated in the burns. If either or both of these factors are absent, it is improbable that an outbreak population of bark beetles will develop and threaten the undamaged stands surrounding the burn. Other factors are important as well, but they have not been studied in detail. Miller and Keen (1960) suggest that timing of a fire according to season, brood success in fire-injured trees, susceptibility of trees in unburned areas, climatic conditions, and the natural trend of infestations are all possible factors influencing the potential for infestations becoming aggressive and attacking surrounding timber.

From the observations made on the Tepee Butte, Pumpkin Creek, and Joseph Canyon fires, and from data evaluated from the Aerial Insect Detection Survey and ground observations, it seems clear that the first condition contributing to bark beetle outbreaks is not present on or near the Tepee Butte burn. Indications are that bark beetle populations are on the rise due to the drought, but levels are not believed to be high enough or concentrated enough over areas near the burn to pose any threat to the stands surrounding the burn. If outbreak populations were to develop on burns that have been monitored and examined in conjunction with this analysis, they would have done so this summer (1988) on the Pumpkin Creek and Joseph Canyon burns; this has not happened, however. Even attacks that have been initiated by bark beetles or woodborers on adjacent green uninjured trees have not been successful. It will not be known until next spring what brood survival is like in these areas, but evidence suggests that regardless of survival, the relatively low populations overall pose little threat to the uninjured resource adjacent to the burn.

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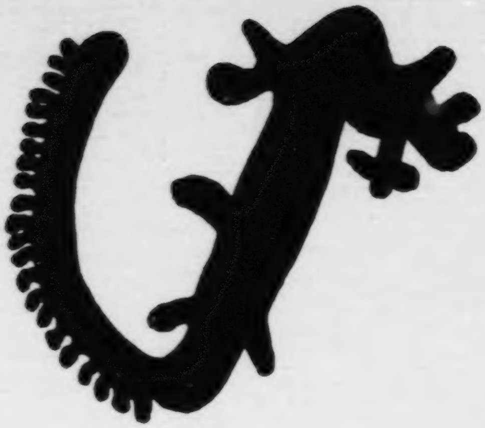

APPENDIX F

SPECIES LIST

SPECIES LIST

TEPEE BUTTE FIRE RECOVERY AREA

The following list of plants, animals, and insects includes only the species mentioned in this document and is not intended to be a biota of the area.

AMPHIBIANS

Frog (tailed)	*Ascaphus truei*

BIRDS

Chukar	*Alectoris chukar*
Cuckoo (yellow-billed)	*Coccyzus americanus*
Dove (mourning)	*Zenaida macroura*
Eagle (bald)	*Haliaetus leucocephalus*
Eagle (golden)	*Aquila chrysaetos*
Falcon (peregrine)	*Falco peregrinus anatum*
Grouse (blue)	*Dendragapus obscurus*
Grouse (ruffed)	*Bonasa umbellus*
Hawk (Ferruginous)	*Buteo regalis*
Hawk (Swainson's)	*Buteo swainsonii*
Junco (dark-eyed)	*Junco hyemalis*
Partridge (Hungarian/grey)	*Perdix perdix*
Quail (California)	*Lophortyx gambelii*
Quail (mountain)	*Oreortyz pictus*
Raven (common)	*Corvus corax*
Warbler (yellow)	*Dendroica petechia*
Woodpecker (black-backed)	*Picoides arcticus*
Woodpecker (downy)	*Picoides pubescens*
Woodpecker (Lewis')	*Melenerpes lewis*
Woodpecker (pileated)	*Dryocopus pileatus*
Woodpecker (three-toed)	*Picoides tridactylus*
Wren (canyon)	*Catherpes mexicanus*

FISH

Redband trout	*Onchorynchus* sp.

INSECTS

Cryptochian (Blue Mountains caddis fly)	*Cryptochia neosa*

(For additional list of forest insects see Appendix E.)

MAMMALS

Badger	*Taxidea taxus*
Bat (spotted)	*Euderma maculatum*
Bat (Townsend's big-eared)	*Plecotus townsendii*
Bear (black)	*Ursus americanus*
Beaver	*Castor canadensis*
Bobcat	*Lynx rufus*
Chipmunk	*Eutamius sp.*
Cougar	*Felis concolor*
Coyote	*Canis latrans*
Deer (mule)	*Odocoileus hemionus*
Elk (Rocky Mountain)	*Cervus canadensis*
Lynx (North American)	*Lynx canadensis*
Mink	*Mustela vision*
Otter	*Lutra canadensis*
Raccoon	*Procyon lotor*
Sheep (Rocky Mt. bighorn)	*Ovis canadensis*
Shrew (Preble's)	*Sorex preblei*
Squirrel (ground)	*Spermophillus sp.*
Wolverine	*Gulo gulo luteus*

PLANTS

Alder (sitka)	*Alnus sinuata*
Alumroot	*Heuchera grossulariifolia grossulariifolia*
Anemone (Oregon)	*Anemone oregana*
Arnica (heartleaf)	*Arnica cordifolia*
Burnett (small)	*Sanguisorba minor*
Brome (mountain)	*Bromus vulgaris*
Clover (white, Dutch)	*Trifolium repens*
Cottonwood (black)	*Populus trichocarpa*
Douglas-fir	*Pseudotsuga menziesii*
Engelmann spruce	*Picea engelmannii*
Fescue (hard)	*Festuca ovina duriscola*
Fescue (sheep)	*Festuca ovina*
Fleabane (yellow)	*Erigeron chrysopsidis brevifolius*
Gooseberry	*Ribes spp.*
Grand fir (white fir)	*Abies grandis*
Huckleberry (big)	*Vaccinium membranaceum*
Indian paint fungus	*Echinodontium tinctorium*
Lace fern	*Cheilanthes feei*
Lodgepole pine	*Pinus contorta*
Maple (Rocky Mountain)	*Acer glabrum*
Mistletoe (dwarf)	*Arceuthobium spp.*
Mitella	*Mitelia spp.*
Ninebark (mallow)	*Physocarpus malvaceus*
Onion (Sierra)	*Allium campanulatum*
Orchard grass (Potomac)	*Dactylis glomerata potomac*
Phacelia (Minute)	*Phacelia minutissima*
Pinegrass	*Calamagrostis rubescens*
Pipsissewa	*Chimaphila umbellata*
Ponderosa pine	*Pinus ponderosa*

Quaking aspen	*Populus tremuloides*
Queen's cup	*Clintonia uniflora*
Snowberry (common)	*Symphoricarpos albus*
Spirea (shiny leaf)	*Spirea betulifolia*
Subalpine fir	*Abies lasiocarpa*
Sweetclover (yellow)	*Melilotus officinalis*
Twinflower	*Linnaea borealis*
Vetch	*Vicia spp.*
Western larch	*Larix occidentalis*
Wheat (winter)	*Triticum aestivum*
Willow	*Salix spp.*

APPENDIX G

ECONOMIC ANALYSIS

ECONOMIC ANALYSIS--MODELS AND METHODS

TEPEE BUTTE FIRE RECOVERY PROJECT
By
Fred Straus, Forester
Dale Pekar, Economist
Eric Siverts, Economist

I. COSTS AND BENEFITS

A. The Economic Efficiency Analysis

This section of the appendix describes the costs and benefits (as well as some concepts involved in economic efficiency analysis), how they were derived, and how they were used in developing the Tepee Butte Recovery Project economic analysis. It addresses the efficiency of operations in the Hells Canyon National Recreation Area (NRA), the dollar value of output, and the dollar value of costs. Concerns about the effects on the local social and economic environments are covered in Section II, Social and Economic Impact Analysis of this appendix.

B. Descriptions of Some Concepts Related to Efficiency Analysis

1. Priced Output

Priced output is output that can be exchanged in the market place. The quantitative values of output are determined by actual market transactions or by estimation methods that produce prices approximating those determined by market transactions.

Timber and forage are examples of commodities that are bought and sold in the market. Their values are determined through the interaction of buyers and sellers, based on supply and demand conditions in the market at the time of the transaction. Dispersed recreation visitor days (RVDs), on the other hand, are not normally purchased in the marketplace. Their assigned values are estimated by using available market transaction data in combination with various theoretical techniques.

Conceptually, these assigned values are consistent and comparable to those values which were actually derived from market transactions (Rosenthal et al. 1985). Therefore, both assigned and market values are appropriate for calculating quantitative measures of efficiency such as Present Net Value (PNV). All benefits and costs are tracked in real terms, i.e., exclusive of inflationary effects.

Timber production, mushroom gathering, sightseeing, reforestation and recreation projects, and big game hunting are the activities which were projected to vary significantly by alternative. Included in the economic analysis were estimates of the costs and benefits for each activity, along with estimates of 25 percent fund amounts that would be returned to counties.

2. Non-priced Output

Non-priced output is output for which there is no available market transaction evidence, and no reasonable basis for estimating a dollar value comparable to the market values associated with the priced output.

In such cases, subjective non-dollar values must be attributed. These values are described qualitatively rather than quantitatively. They may be either positive or negative. In fact, what may be considered to be a benefit by one individual may be considered a cost by another.

Examples of non-priced output includes protection of threatened and endangered species habitat; preservation of natural and scientific areas; protection of historical and anthropological sites; and providing for visual and air quality. Some of this non-priced output is reflected in priced output, e.g., recreation levels are influenced by visual and air quality.

3. Discounting

Analyses of alternative investment options usually involve cash flows over different periods of time. Due to a number of factors, including the uses to which money can be applied, a dollar received today is worth more than a dollar received ten years from now. Discounting is a process whereby the dollar values of costs and benefits which occur at different time periods are adjusted to a common time period so that they can be compared.

In this analysis, the common time period is the present year (1989), in which case the discounted value is referred to as a present value. The real discount rate used in the analysis is 4 percent, which excludes effects of inflation.

4. Present Net Value (PNV)

Present net value is the difference between the discounted values of dollar-quantified benefits and dollar-quantified costs of managing the project area. As Forest Service Manual (FSM) 1971.2 states, PNV is "...the primary measure of economic efficiency for use in comparing alternatives."

The period of analysis used is 10 years. The analysis therefore reflects some changes that occur over time. The 10-year period was used because it was felt that no projections of timber yields or other resource improvement projects could be made beyond 10 years with reasonable accuracy. This is due to possible changes in the Allowable Sale Quantity (ASQ) and availability of new data from a Forest inventory. Present net value calculations consider only the benefits and costs which have been dollar-quantified.

Priced benefits include timber output, mushroom gathering, sightseeing, reforestation/recreation projects, and big game hunting. These benefits were compared to their related costs. PNV is an estimate of the difference between an alternative's dollar-quantified benefits and the related dollar-quantified costs. Present Net Value is equivalent to a one-time, up-front, lump sum payment. If PNV is positive, then the payment is to the people of the United States. If PNV is negative, then the payment is in the form of a cost to the people of the United States.

Because other costs and benefits identified for the project are described on an annual basis, the annual equivalent of the Present Net Value is frequently more meaningful to the decisionmaker. A PNV of $1 million is equivalent to an annual payment of $40,808 for a hundred years at a discount rate of four percent. Another way to look at it is that a payment of $1,000 per year for 10 years is worth $8,435 today.

5. Opportunity Costs

Opportunity costs are defined as the value of a resource's foregone net benefit in its most economically efficient alternative use (FSM 1970.5).

In relation to the economic analysis performed for this recovery project, these costs represent the decrease in PNV which occurs when an alternative other than the one with the highest level of PNV is selected. Therefore, opportunity costs measure the net change in PNV for priced resource output and associated costs, and can be used to measure the net value sacrificed in order to produce the non-priced benefits included in net public benefits.

Consider an example. Alternative X has a PNV of $1,000,000 and provides an acceptable degree of visual quality. Alternative Y has a PNV of $750,000 and provides an exceptional degree of visual quality. By selecting Alternative Y a decisionmaker would be saying that the visual quality would be worth at least $250,000. The annual equivalent of that $250,000 one-time, up-front, lump sum payment would be $10,202 annually for a hundred years.

6. Net Public Benefits (NPB)

Maximization of net public benefits is the objective of the decisionmaker. Net public benefits is the overall value to the Nation of all output and positive effects (benefits) less all the associated input and negative effects (costs), whether they can be quantitatively valued or not. Net public benefits cannot be expressed numerically because the concept includes qualitatively-valued output. Conceptually, net public benefits are the sum of the present net value of priced output plus the present net value of all non-priced output. Net public benefits were not developed for this project.

7. Distribution Effects and Impacts

There is another level of effects which is also a concern to management. These effects are the distribution of effects influenced by the mix and level of output produced by the project area and for a larger area, the Wallowa-Whitman National Forest. They can be either positive or negative. They include jobs, wage income and payments to local governments. These concerns are more related to questions of equity (i.e. who pays and who benefits), rather than questions of efficiency. They are not assessed in the context of the efficiency criteria associated with PNV.

C. Parameters and Assumptions Used For Economic Efficiency Analyses

In order to calculate the Present Net Value (PNV) for each alternative, assumptions had to be made regarding discount rates, demand functions, a common reference point in time for dollar values, and real price and cost trends. This section summarizes these decisions and their resulting parameters.

This appendix is not intended to provide a detailed account of how the analysis was performed. Rather, it seeks to outline the process which was used.

1. Discount Rates

Discounting involves the application of a discount rate that represents the time value of money in determining the present value of future costs and benefits. A 4 percent real discount rate was used to calculate the present net value for each alternative.

As a real discount rate, it excludes the effects of inflation. This is not to imply that there will be no inflation. It is, rather, an assumption that the costs and benefits presented in the analysis will generally increase or decrease at the same rate as the rate of inflation. According to FSM 1971.21:

> Use a 4 percent real discount rate for evaluations of long-term investments and operations in land and resource management. Also, determine the sensitivity of alternatives to variations in the discount rate. At a minimum, use the rate used in the most recent Resources Program and Assessment to test sensitivity.

The 4 percent rate approximates the "real" return on corporate long-range investments above the rate of inflation (Rowe et al. 1981). The 4 percent rate was used during the Forest planning process. The 1985 Resources Planning Act (RPA) Program used a real discount rate of 10 percent. All costs and benefits were calculated as average annual figures and were discounted accordingly.

The discount rate is not equivalent to the Federal government's cost of borrowing money (the interest rate paid for Federal securities). It reflects, rather, the political, social, and economic needs and aspirations of the Nation's citizens today and in the future. How much should those living today be willing to sacrifice for those living in the future? How much of the earnings of future generations should those living today be willing to sacrifice in order to achieve a desired end?

In brief, the discount rate used in the analysis is not the same as the cost of borrowing money because:

-- The cost of borrowing money includes a payment for inflation. The higher the rate of inflation envisioned by the lender, the higher will be the cost of borrowing. The economic analysis assumes that costs and benefits will generally change at the same rate as inflation, thus enabling us to work with a real discount rate, net of inflation.

-- The cost of borrowing money reflects the market conditions in effect at the time the money is borrowed. The discount rate reflects our society's judgement as to whether the Nation's common wealth will be enhanced or reduced by the decision.

2. The Significance of the Discount Rate Used in the Analysis

The analysis process was not driven by the discount rate. The selection of activities and output would be the same even if a different discount rate had been selected. The model used was not an "optimizing" model such as FORPLAN (Kelly et al. 1986). Rather, the alternatives were constructed to respond in different ways to the issues which surfaced during the scoping process. Each alternative had its own unique blend of emphases which were not triggered by the selection of a discount rate. The mix would have been the same even had the discount varied up or down by five points. Changes greater than that would likely indicate a profound shift in the Nation's political economy which would in turn shift the identification of issues.

3. Demand Functions, Real Prices, and Real Costs

Timber production, mushroom gathering, sightseeing, reforestation and recreation projects, and big game hunting are the activities which are included in the Tepee Butte project economic analysis. The levels of output being considered are small, relative to the overall level of supply of these goods and services in the economic analysis area. Accordingly, no changes in real prices are anticipated as a result of selection of any one of the alternatives.

All cost and benefit data are expressed in 1989 dollars unless otherwise indicated. The GNP Implicit Price Deflator was used to convert historical prices and costs to this common base year. The actual conversion factors are shown below in Figure G-1.

Figure G-1
GNP Implicit Price Deflators

1989	1988	1987	1986	1985	1984	1983	1982
125.1	121.5	118.0	114.5	111.5	107.9	103.9	100.00

No real cost or price changes have been assumed.

D. Costs Included in the Economic Efficiency (PNV) Analysis

This section describes the costs identified in the economic efficiency analysis for each of the alternatives considered during the development of the DEIS.

Only Forest Service costs relevant to overall timber management and recreation in the Hells Canyon NRA were included for the purposes of estimating budgets and calculating the present net value for each alternative. Timber costs were identified by their Timber Sale Program Information Reporting System (TSPIRS) budget codes. The budget codes with their related descriptions were useful for identifying how different costs would be treated during the planning process.

1. Timber Costs

The discounted costs of timber which would be harvested under the various alternatives were estimated using an economic modeling program called PJSALES (Pekar and Straus 1989). The values used in this program are outlined below.

a. Sale preparation costs

For salvage sale preparation the values used were the Forest-wide averages based on 1987 costs. All the EIS development costs are treated as sunk costs, and are not included as part of the sale preparation cost. This money would be spent even if there is no timber sale.

Activity	Cost $/MBF
Sale Preparation	13.44
Road Engineering	2.20
Project Support	1.00
Total	19.39

b. Sale administration costs

The Forest average in terms of dollar/MBF was used. These values were prepared in 1988 from 1987 costs.

Activity	Cost $/MBF
Harvest Supervision	7.09
Construction supervision	1.44
Project Support	1.00
Total	9.53

c. Road Construction/reconstruction

The actual projected costs generated by Forest Engineers was used. Cost varied by alternative; for reconstruction, costs varied from $9,400 to $12,000/mi.; construction costs varied from $10,000 to $48,940/mi.

d. Site preparation and/or planting costs

The project Silviculturist provided a cost of $335/ac. which was used in all alternatives.

e. Discount rate

The rate for NEPA analysis (4 percent), as set by the USDA Forest Service Washington Office was used.

f. Profit and Risk

The high end of the Region 6 appraisal rate was used due to the increased operating risks associated with salvage sales. A value of 11 percent was used.

g. Volume Computations

Volumes were developed for each unit using the Geographic Information System (GIS). Data was collected for each species and diameter grouping for the entire fire during Fall, 1988. This data was input to the computer in a form which allowed the IDT to select the species and diameter mix for each cutting-unit. This information was then used to develop the volumes displayed for each alternative.

2. Recreation Project Costs

During the course of the analysis process, the need for several recreation improvements was identified. The costs associated with these projects have been estimated and are included in the analysis. See Appendix H for costs.

3. Costs Not Included in the Economic Analyses

Costs which are not expected to vary significantly by alternative were generally excluded from the analysis. Likewise excluded were those costs which could not be reliably predicted.

The guiding principle for identifying costs is contained in FSM 1971.4:

> Limit identification of economic costs to only those costs in the production process up to the point of evaluation or to those costs that influence the values of output.

4. Fixed Costs

A cost was classified "fixed" if it was not expected to vary significantly over the range of alternatives considered. An example of a fixed cost (that was not included) is the cost of preparing the EIS.

5. Variable Costs

All other costs are classified "variable". For instance, varying amounts of forage may be provided for wildlife by changing the amounts of material logged, acres left in visual buffers, or acres reforested.

E. Benefits Considered in Economic Efficiency Calculations

This section describes the benefits which were incorporated in the economic efficiency analysis for each alternative considered during the development of the EIS. Dollar-quantified output comprise the benefits included in the present net value calculations. Like the costs included in the analysis, only those benefits incurred during the 10-year planning horizon were incorporated in the PNV calculations. This period of analysis is adequate to capture all significant residual costs and benefits.

Priced benefits included in this analysis are those associated with timber and mushroom products, and wildlife and recreation activities (sightseeing and big game hunting). As FSM 1971.52 states:

> Determine values only for outputs that the Forest Service sells or potentially could sell, if the law or Forest Service policy permitted.

There are other benefits (such as camping) for which values are frequently estimated in an economic analysis, but were not included in this project because they were not expected to vary significantly among the alternatives.

All benefits are valued at the most recent unit values, price-updated to 1989. For timber products, the dollar value used is the price of the processed lumber when it leaves the mill (selling value). The manufacturing and logging costs are subtracted from this dollar value to arrive at an appraised value. The unit of measure is thousand board feet (MBF) or millions of dollars.

1. Timber Products

The selling values (labeled "Green") as derived from the Region 6 appraisal program based on a log stock table from the Bluebird timber sale (located adjacent to the project area) were used. The value for dead ponderosa pine was adjusted for blue stain as outlined in Appendix A. The average weighted value of ponderosa pine was used, based on the volume of dead and severely damaged timber to be included in each alternative as shown below.

Figure G-2
Species Selling Values
MBF = thousand board feet

Species		Value $/MBF			Total		Average Weighted Value
		Green	Dead	Hog fuel	Green	Dead	
Ponderosa pine	Sell	627.38	487.37	2.23	629.61	489.60	505.11
	Mfg	139.96	139.96	.99	140.95	140.95	
Douglas-fir	Sell	403.46		5.17	408.63		
	Mfg	186.72		1.20	187.92		
Western larch	Sell	417.44		5.17	422.61		
	Mfg	178.67		1.20	179.87		
Grand fir	Sell	369.55		5.17	374.72		
	Mfg	195.00		1.20	196.20		
Subalpine fir	Sell	369.55		5.17	374.72		
	Mfg	195.00		1.20	196.20		
Lodgepole pine	Sell	217.00		2.23	219.23		
	Mfg	133.25		.99	134.24		
Engelmann spr.	Sell	306.03		5.17	311.20		
	Mfg	172.00		1.20	174.20		

The value for chip and by-products was adjusted down to 20 percent of the original to remove the value of the chips. Chips from fire-killed trees have no value to the mills except as hog fuel.

2. Manufacturing costs

The costs, as derived from the Region 6 appraisal program, based on a log stock table from the Bluebird timber sale, were used. The value for chip manufacturing cost was removed (see Figure G-2 above).

3. Bid premium

The averages for the three north end districts (Wallowa Valley, Hells Canyon, Eagle Cap) for the last 5 years was used (labeled "All North End Sales" in the table below). This was derived from the 2400-17's ("Report of Convertible and Non-convertible Products") for all sales offered and sold by the three districts for the time period. The relationship between Forest-wide averages and north end salvage sales is shown in the following Figure G-3.

Figure G-3
BID PREMIUM
Values based on a 5-year average

Species	Forest	All North End Sales	North End Salvage Only
Grand fir	19.84	25.33	0.00
Western larch	0.00	5.04	1.00
Engelmann spruce	0.00	7.69	0.00
Lodgepole pine	6.07	27.31	11.87
Ponderosa pine	31.19	22.23	12.30
Douglas-fir	20.18	12.47	6.27
Average	11.25	18.22	8.16

2. **Wildlife and Recreation Activities**

Wildlife/recreation values are also those that reflect what people are willing to pay on arriving at the Forest for recreational activities. The unit of measure is the RVD (recreation visitor day) or the WFUD (wildlife or fish user day). The latter unit of measure is used when recreation involves the use of fish or wildlife, whether consumptively or non-consumptively. The wildlife/recreation values used are shown below in Figure G-4.

Figure G-4

WILDLIFE/RECREATION UNIT VALUES USED
TEPEE BUTTE RECOVERY PROJECT 1/

	1982 Recreation Category	Unit Value	1989 Value
1	WFUD hunting	$30	$38
2	RVD hiking	$10	$13
3	Mushroom gathering	$16	$20

GNP price index of 125.1 used to derive 1989 value. Values rounded to the nearest whole dollar.

1/ USDA Forest Service. 1985. Draft Environmental Impact Statement, 1985-2030. Resources Planning Act Program. Table F.2, NFS Benefit Values--1985 Program by Resource Activity and Region (1982 Dollars). Washington, DC.

Due to the effects of the fire, the Oregon Department of Fish and Wildlife (ODF&W) will be reducing the number of deer and elk hunting tags which they will be issuing in the Chesnimnus hunting allotment. While the fire area comprises 30 percent of the allotment, all of the reduction in tags is associated with the fire area. Because of this, the entire reduction in value of hunting has been assumed in the analysis of the project.

The value used for big game hunting was obtained from the 1985 Resource Planning Act (RPA) analysis and was used for all types of big game hunting (elk, deer, archery hunting, etc.).

From the experience of the fires in 1986, it was found that mushroom gathering, both commercial and recreational, increased significantly; therefore, an economic value was placed on this product. The value used for mushroom gathering is shown in Figure G-4, and is based on the wilderness value for Region 6.

F. Consideration of Non-quantified Costs and Benefits

The calculation of Present Net Value (PNV) provides efficiency data for the alternatives. However, other factors also influence the decisionmaking process. In some cases the importance of non-priced benefits, for which it is unrealistic to assign monetary values, can outweigh the advantages of a higher PNV.

It is very difficult to put a dollar value on something like visual quality, visibility, air quality, public health, ecosystem diversity, or the potential values of timber species which are not now used. Values can be assigned to all of these things. Everybody assigns them a value in their own lives--in determining where they live, where they vacation, what kinds of food they eat, how they manage their own land, etc. There is difficulty though in standardizing value, in presenting a value which represents the feelings of the citizenry and the individual's ability to purchase.

Rather than try to assign dollar-value to all of these concerns (many of which are not even easily counted in physical terms), their consideration has been left to the decisionmaker. As 40 CFR 1502.23 states:

> ...For purposes of complying with the National Environmental Policy Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be, when there are important qualitative considerations...

Selection of a preferred alternative is not a mathematical process. The decisionmaker must consider the subjective benefits and costs of proposed actions, as well as those which provide dollar gain. National Forest Management Act (NFMA) regulations specifically mandate the Forest Service to identify the alternative which comes nearest to maximizing net public benefits (36 CFR 219.12 (F)).

Net public benefit (NPB) represents the overall value to the Nation of all output and positive effects (benefits), less all associated input and negative effects (costs), whether or not they can be quantitatively valued. (36 CFR 219.3).

Net public benefits include both priced and non-priced resource output, less all costs associated with management. As stated earlier, not all of the output and costs associated with management of the Hells Canyon NRA are included in the calculation of PNV. Only those values which vary significantly by alternative were included in the analysis in order to arrive at the overall NPB of an alternative. The more important concerns addressed during the planning process were those identified as issues. Issues have both priced and non-priced dimensions.

* Will recreation opportunities be limited or altered significantly?

* Will visual quality be reduced by management activities?

* Will the lost streamside cover affect water temperature to such an extent that fish habitat will be lost?

* Will long-term site productivity be lost or reduced?

The management alternative selected for the Tepee Butte Recovery project will address each of these issues. Implementation of project activities will have varying effects on the area's resources. Efficiency will be weighed with equity, considering both positive and negative effects.

G. How the Efficiency Analysis Was Done

The analysis was separated into three principal components. First, the costs and benefits were derived for the timber resource using the economic modeling program PJSALES (Pekar and Straus 1989). Data for this section was taken from the GIS data base and supplemented with other data as necessary. Second, the benefits and costs associated with recreation use, wildlife, and recovery projects were assembled in a spreadsheet model that discounted costs and values for the 10-year evaluation period. Third, the total benefits were obtained by totaling the values for timber, recreation, wildlife, and recovery projects. The results of this analysis are shown in Figure G-5.

H. Results of the Analysis

The following figures (G-5, G-6) display the PNV of costs and benefits for each alternative for the various resources identified.

Figure G-5

Present Net Value of Costs and Benefits
Relationship of Resource values by Alternative
in Thousands of Dollars (1989 Dollars)

Resource value	Alternative									
	A		G		H		I		J	
	Cost	Bnfit	Cost	Bnfit	Cost	Bnfit	Cost	Bnfit	Cost	Bnfit
Recreation rehab projects and sale implementation			1,222		881		917		1,329	
Sightseeing		295		289		289		371		305
Mushroom gathering		804		633		633		804		664
Big game hunting										
Deer Hunting		6,010		2,004		2,004		2,004		2,004
Elk Hunting		6,345		5,577		7,116		6,347		5,962
Archery Hunting		5,049		5,049		5,049		5,049		5,049
Timber Harvest										
Lumber selling value		0		12,298		2,978		0		9,037
Logging costs	0		5,955		1,436		0		4,340	
Specified roads	0		348		218		0		342	
Lumber mfg cost	0		5,706		1,393		0		4,201	
Profit/risk	0		1,240		300		0		911	
Reforestation	0		332		164		45		298	
Bid premium		0		0		0		0		0
Total value benefits		18,503		25,850		18,069		14,575		23,021
Total value costs	0		14,803		4,392		962		11,421	
Net Present Value	18,503		11,047		13,677		13,613		11,600	

Note: A bid premium of zero was used in the analysis, because all alternatives' sales appraised in deficit. It would be inappropriate to estimate the amount of overbid that could be expected on such salvage sales.

Figure G-6 displays the costs and volumes by alternative for the proposed timber sales. Appraised values were determined using the economic model PJSALES. For a further discussion of this model see the process paper 'PJSALES' by Dale Pekar and Fred Straus.

Figure G-6
Timber sale Values by Alternative

	Alternative				
	A	G	H	I	J
Appraised Net Value	0.00	(30.93)	(49.54)	0.00	(33.47)
Volume by species MBF					
Ponderosa pine	0	3,400	700	0	2,500
Douglas-fir	0	10,400	2,800	0	7,400
Western larch	0	1,300	100	0	1,100
Grand fir	0	14,500	3,600	0	10,700
Subalpine fir	0	0	0	0	0
Lodgepole pine	0	100	0	0	100
Englemann spruce	0	1,000	300	0	900
Total	0	30,700	7,500	0	22,600
Optional volume	0	3,500	500	0	3,400
Specified roads					
Construction	0	3.9	2.7	0	3.9
Reconstruction	0	16.7	16.7	0	16.7
Volume by allocation					
DR/TM	0	27,500	7,500	0	22,600
Forage	0	3,200	0	0	0
DR/NV	0	0	0		
Total		30,700	7,500	0	22,600
Acres harvested by allocation					
DR/TM	0	3,151	1,247	0	3,031
Forage	0	269	0	0	0
DR/NV	0	0	0	0	0
Total	0	3,420	1,247	0	3,031
Acres reforested by allocation					
DR/TM	0	608	170	303	608
Forage	0	269	269	0	269
DR/NV	0	0	0	0	0
Total	0	877	439	303	877

II. SOCIAL AND ECONOMIC IMPACT ANALYSIS

A. Social and Economic Overview

Area of Influence Established for Economic Analysis

To assess the current economic conditions and to estimate potential changes, an Area of Influence was determined. This is the geographic area most affected by management of the Hells Canyon NRA. It comprises the counties shown in Figure G-7, displaying the area's population over time. Because of their proximity to the NRA, Wallowa, Union, and Baker counties in Oregon would be most affected by Tepee Butte Project activities.

Figure G-7

AREA POPULATION OVER TIME

County	1930	1940	1950	1960	1970	1980 2/	1987 3/
Baker	16,754	18,297	16,175	17,295	14,919	16,127	15,300
Union	17,492	17,399	17,962	18,180	19,377	23,935	23,300
Wallowa	7,814	7,623	7,264	7,102	6,247	7,269	7,150
Tri-County	42,060	43,319	41,101	42,577	40,543	47,331	45,750

1/All columns except 1980 and 1987: (Mackey 1978)
2/Preliminary census figures.
3/1987 figures from "Labor Trend," State of Oregon Employment Division, Department of Human Resources, November 10, 1988 issue.

B. Determination of Social Effects

1. Social Effects

Social effects can be described as changes within communities, changes in peoples' beliefs, and in ways of life. The social effects of management of the Hells Canyon NRA reflect changes in social conditions.

a. Lifestyle and Job Dependence: Effects are indicated by significant changes from baseline conditions in wildlife habitat, and in the patterns of work, leisure, and other activities. Dimensions include the availability and characteristics of wildlife habitat, jobs and recreational activities, aesthetic and amenity ties, and the gathering and use of Forest products.

b. Beliefs and Perceptions: Significant effects are indicated by output and practices which are at odds with the understandings of NRA management and the emotional values which people assign to the NRA.

Dimensions include concerns that wildlife needs will not be met, that familiar places will be changed, and that disliked or unsound practices will occur. People have concerns for visual quality, for Hells Canyon NRA as a natural or managed ecosystem, for environmental quality, and for historical and cultural sites and characteristics.

2. Categories of Social Effects Considered, But Not in Detail for Each Alternative

In addition to these main categories of social effects, the effects of project implementation on population change and the effects on land use and ownership were examined. Selection of a management alternative for the Tepee Butte Project is not expected to generate sizeable impacts on the area of influence. The range of output and activities under consideration are expected to result in only a very minor population change.

Any employment-induced population change would be affected by unemployment levels in the Tri-County area of influence. In recent years, migration has been responsive to employment opportunities and to a variety of amenity and lifestyle factors, so that a precise population projection tied to Tepee Butte management alternatives is not presented. However, employment and population are generally recognized as being directly related.

C. Economic Impact Analysis

This section describes procedures used in conducting the economic impact analysis for the Tepee Butte Fire Recovery project. The objective of an impact analysis is to define the regional economic response that various industries will have to project-induced changes. The steps involved in conducting this analysis are: 1) define the area, 2) construct the impact model, 3) estimate local industry sales associated with project components, and 4) estimate the number of jobs and amount of wage income associated with the entire project.

1. Define the area

As discussed above, because of their close proximity to the burned area, the Tri-County area comprised of Wallowa, Union, and Baker, Oregon described the area expected to experience most of the project-related impacts. Effects are apt to be most noticeable in Wallowa and Union counties because their wood processing mills have a locational advantage in bidding on timber offerings, and there are service and trade sectors that support recreational and hunting use.

2. Construct the Impact model (IMPLAN)

An input-output model for the tri-county area was developed following procedures outlined for constructing IMPLAN version 2.0 models (Palmer et al.

1985; Alward 1987; Alward 1989). The model was constructed using the microcomputer-based system, Release 87-03. The resulting model provided detail for 146 separate economic sectors. A standard matrix of multipliers for estimating the direct, indirect and induced effects was used to define the total economic effects.

3. Estimate local industry sales associated with project components.

Project components that were evaluated consist of:

a. Processed timber products (e.g., dimensional lumber and plywood)

b. Government expenditures for timber, reforestation, and recreation projects

c. Effect of 25 percent payments to counties

d. Gathering of mushrooms

e. Consumer expenditures associated with big game hunting

Estimates of industry sales associated with each component were designed using procedures outlined in the IMPLAN analysis guide (Palmer et al. 1985). Only the principal assumptions for each component are highlighted here. Stumpage sold from the project area was assumed to be processed by sawmill, plywood, and particle board industries, with their products sold to export markets. Government expenditures included both labor and commodity purchases as designated by Forest Service budget object codes. Effects of the 25 percent fund payments were separated, with the assumption that 25 percent was spent for education and 75 percent was spent for roads 1/. It was assumed that mushrooms are gathered and sold to export markets without further processing in the tri-county area. A set of expenditures for those individuals participating in big game hunting was defined for the Tri-County area.

4. Estimate the jobs and income for the total project.

All sales amounts were expressed on a per unit basis in 1982 dollars to define a set of response coefficients. Response coefficents were then multiplied by the levels of activity for each alternative to give the total estimate of jobs and wage income for the project. Wage income was price-adjusted using the correct GNP price index to express the values in 1989 dollars in Figures G-8 and G-9 below.

1/The Adequacy of Federal Compensation to Local Governments for Tax Exempt Federal Lands, prepared by Advisory Commission on Intergovernmental Relations, Washington, DC 20575. July 1978. A-68.

Figure G-8 displays the values derived from the IMPLAN analysis. The relationship of jobs to the proposed activities can be estimated by taking the projected output from each alternative and expanding them by these multipliers. The result is an estimate of the number of jobs which are related to each alternative.

Figure G-8

Relationship of Jobs to Management Effects

Processed Timber Products	(Per MMBF)
Direct Jobs	3.48
Indirect Jobs	1.25
Induced Jobs	1.44
Total Jobs	6.17
Commercial Mushroom Gathering	(Per thousand acres of area)
Direct Jobs	1.99
Indirect Jobs	0.37
Induced Jobs	0.58
Total Jobs	2.94
Government Expenditures for Timber, Reforestation, and Recreation Projects	(Per hundred million dollars)
Direct Jobs	2,810.45
Indirect Jobs	183.62
Induced Jobs	967.65
Total Jobs	3,961.72
25% Payments to Counties	(Per hundred million dollars)
Direct Jobs	23.79
Indirect Jobs	2.91
Induced Jobs	8.51
Total Jobs	35.21
Big Game Hunting	(Per million RVD's and WFUD's)
Direct Jobs	1,034.23
Indirect Jobs	111.98
Induced Jobs	370.44
Total Jobs	1,516.65

Direct jobs (and wage income) are in those sectors of the economy which receive the initial increase in sales. For instance, money is injected into the local economy in the case of big game hunting when hunters make local purchases from the retail trade sector. Direct jobs are in the firms that make those sales.

Indirect jobs (and wage income) are in firms that make sales to the sectors that receive the initial increase in sales. Continuing the example of big game hunting, the retail trade sector makes purchases from the wholesale trade sector, which would generate indirect jobs in wholesale trade firms.

The term "induced" refers to the jobs and wage income effects generated when those employed directly or indirectly then spend their money in the local economy. This term is sometimes referred to as the household effect or consumer effect.

"Jobs" includes full- and part-time positions, temporary and permanent positions without discrimination. Many people are uncomfortable with this usage. They feel more comfortable with the use of some kind of full-time equivalency. Such an estimate can be provided by dividing the Personal Income coefficient by a representative annual wage. For instance, Figure G-9 shows a total personal income coefficient of .0919 million per million board feet--that's some $91,900 in wages and salaries per million board feet of timber. To get an annual equivalent of $25,000 per year jobs, divide the $91,900 by $25,000, or 3.7 jobs. That would provide a rough equivalent in terms of full-time jobs.

Figure G-9

Relationship of Wage Income to Management Effects
(1982 Million Dollars--1989 Million Dollars)

Processed Timber Products	(Per MMBF)
Direct Personal Income	.0919
Indirect Personal Income	.0336
Induced Personal Income	.0194
Total Personal Income	.1449
Commercial Mushroom Gathering	(Per thousand acres of area)
Direct Personal Income	.0098
Indirect Personal Income	.0035
Induced Personal Income	.0077
Total Personal Income	.0210
Government Expenditures for timber, reforestation, and recreation projects	(Per hundred million dollars)
Direct Personal Income	29.6781
Indirect Personal Income	3.0668
Induced Personal Income	13.0090
Total Personal Income	45.7539
25% Payments to Counties	(Per hundred million dollars)
Direct Personal Income	.3173
Indirect Personal Income	.0418
Induced Personal Income	.1144
Total Personal Income	.4735
Big Game Hunting	(Per MRVDs or MWFUDs)
Direct Personal Income	13.5314
Indirect Personal Income	1.5356
Induced Personal Income	4.9802
Total Personal Income	20.0472

Dollar values developed by IMPLAN are in 1982 terms. To provide some idea of how these 1982 dollars would be expressed in today's terms, the 1982 figures were converted to 1989 figures using the Gross National Product Implicit Price Deflator.

Direct jobs (and wage income) are associated with those sectors of the economy which realize the increase in sales. For instance, money is injected into the local economy in the case of timber sale offerings when the timber has been manufactured into its final form and the products are sold. Direct wage income effects are realized in manufacturing firms that make those sales.

Indirect jobs (and wage income) are associated with firms that supply the wood processing sector, such as logging contractors. The term "induced" refers to the job and income effects generated when those employed directly or indirectly re-spend their money in the local economy.

"Wage Income" is not differentiated based on the source of the income.

D. Uncertainty in the analysis

It is important to "...recognize that all unit values, and especially future values, are only approximations of the worth of the output, and are used to assist in placing relative priorities on plan or project alternatives, along with numerous other criteria." (FSM 1971.63--1.d., since superseded)

1. Projections

Projections into the future are necessarily uncertain. This includes such things as the growth rates of timber and projected product value. The farther the projection is made into the future, the greater will be the uncertainty.

As far as efficiency considerations, budget concerns, and local economic impacts are concerned, the analysis showed a relatively small effect to be associated with the Tepee Butte Project. This, in part, is a reflection of the fact that the Tepee Butte area is a small contributor to the area's supply of sawtimber, livestock forage, and wildlife/recreation opportunities.

2. Historical Data

The estimates of jobs and wage income should also be considered relative approximations. They are all based on the physical data, and therefore, share in all the uncertainty implicit in those estimates. Beyond those concerns, jobs and wage income estimates are necessarily approximate in that they were derived from the IMPLAN system which uses 1977 National average technological coefficients, updated to 1982. Any changes in regional technology or trading patterns since 1982 are not reflected in the impact analysis.

Many improvements have been made in productivity in the timber industry and in other industries since the technological coefficients were developed. These are a continuation of efforts recognized throughout history to increase efficiency. Much of this increased efficiency has come about as capital equipment has been substituted for labor. That capital/labor substitution effect should not overshadow the fact that additional local processing of material is a possibility as well.

Payments to local governments are primarily a function of Forest stumpage values--values which can be modified through changes in the appraisal process, the period allowed a contractor for harvesting the timber, as well as legislative changes, etc.

The values in figures ((G-8, G-9) represent jobs and income on a per million dollar, hundred million dollar, thousand acre, or MBF (thousand board feet) basis; that is, how many jobs and how much associated income will be created or maintained for each million board feet or dollars invested. This is what is known as a response coefficient. Figure G-10 displays the use of these coefficients as applied to each alternative and displays an estimate of the number of jobs that would be maintained or created by implementing that alternative. Figure G-11 does the same for the amount of employee compensation that would be generated.

Figure G-10
Relationship of Jobs to Management Effects by Alternative
Estimated Number of Jobs Provided by Alternative

Sector	Alternative				
	A	G	H	I	J
Processed Wood Products					
Direct Jobs	0.0	106.8	26.1	0.0	78.6
Indirect Jobs	0.0	38.4	9.4	0.0	28.3
Induced Jobs	0.0	44.2	10.8	0.0	32.5
Total Jobs for Sector	0.0	189.4	46.3	0.0	139.4
Commercial Mushroom Gathering					
Direct Jobs	32.4	18.1	19.1	32.4	20.7
Indirect Jobs	6.0	3.4	3.6	6.0	3.9
Induced Jobs	9.4	5.3	5.6	9.4	6.0
Total Jobs for Sector	47.8	26.8	28.2	47.8	30.6
Reforestation/Recreation					
Direct Jobs	0.0	35.5	15.8	4.4	31.7
Indirect Jobs	0.0	3.2	1.3	0.3	2.7
Induced Jobs	0.0	12.4	5.5	1.5	11.1
Total Jobs for Sector	0.0	51.1	22.6	6.3	45.4
Big Game Hunting					
Direct Jobs	55.4	40.7	45.7	43.2	42.0
Indirect Jobs	6.0	4.4	4.9	4.7	4.5
Induced Jobs	19.8	14.6	16.4	15.5	15.0
Total Jobs for Sector	81.2	59.8	67.0	63.4	61.6
Payments to Counties					
Direct Jobs	0.0	2.8	0.7	0.0	2.1
Indirect Jobs	0.0	0.2	0.1	0.0	0.1
Induced Jobs	0.0	0.9	0.2	0.0	0.7
Total Jobs for Sector	0.0	3.9	1.0	0.0	2.9

Figure G-11 uses the wage income response coefficients for displaying the total employment compensation for each of the sectors or resource areas analyzed. To determine the relative value of each job, divide the employee compensation number in this table by the number of jobs shown in the previous table for the sector. The value derived will represent the relative dollar value per job. All values are expressed in 1989 dollars.

Figure G-11
Relationship of Personal Income to Management Effects by Alternative
(1989 Million Dollars)

Sector	Alternative				
	A	G	H	I	J
Processed Wood Products					
Direct Jobs	0.000	2.823	0.690	0.000	2.078
Indirect Jobs	0.000	1.030	0.252	0.000	0.759
Induced Jobs	0.000	0.594	0.145	0.000	0.437
Total Jobs for Sector	0.000	4.447	1.087	0.000	3.274
Commercial Mushroom Gathering					
Direct Jobs	0.159	0.089	0.094	0.159	0.102
Indirect Jobs	0.057	0.032	0.034	0.057	0.036
Induced Jobs	0.126	0.070	0.074	0.126	0.080
Total Jobs for Sector	0.342	0.191	0.202	0.342	0.219
Reforestation/Recreation					
Direct Jobs	0.000	0.416	0.180	0.048	0.367
Indirect Jobs	0.000	0.049	0.020	0.005	0.042
Induced Jobs	0.000	0.167	0.074	0.021	0.149
Total Jobs for Sector	0.000	0.632	0.274	0.073	0.558
Big Game Hunting					
Direct Jobs	0.725	0.533	0.598	0.566	0.549
Indirect Jobs	0.082	0.061	0.068	0.064	0.062
Induced Jobs	0.267	0.196	0.220	0.208	0.202
Total Jobs for Sector	1.074	0.790	0.886	0.838	0.814
Payments to Counties					
Direct Jobs	0.000	0.017	0.004	0.000	0.013
Indirect Jobs	0.000	0.003	0.001	0.000	0.002
Induced Jobs	0.000	0.013	0.003	0.000	0.009
Total Jobs for Sector	0.000	0.023	0.008	0.000	0.024

Figure G-12 displays the estimate of 25 percent fund payments to Wallowa County. It is based on the assumption that the timber will sell for an average base rate of $9.53/MBF. All sales are deficit and it was assumed that there would be no overbid.

Figure G-12

Payments to Counties By Alternative
Estimated on an average weighted bid of $9.53/MBF
Thousands of Dollars

	Alternative				
	A	G	H	I	J
Payment	00.0	73.1	17.9	00.0	53.8

Figures G-13 and G-14 display the volume and acres remaining by alternative by CMP allocation. The Dead/Damaged component consists of the fire-killed or stressed trees which will not be harvested under the alternative. This volume was left for various reasons, based on the theme of the alternative and the allocation in which it is located. The green volume is comprised of all undamaged timber which remains (after the fire). This timber was not considered for harvest under any alternative and is only displayed to better represent the existing condition. The first column displays the total volume or acreage within the category. The second column shows that component which is classified as satisfactory wildlife cover following the fire. It should be noted that some marginal cover was excluded from harvest under the alternatives, but was not shown on this table. The third column displays the component within the Stream Side Management Units, the buffer areas along Class I, II, or III streams. The last column represents the designated Old Growth.

Figure G-13
Timber Volume Remaining following Harvest

ALTERNATIVE G CMP Allocation	Total	Sat. Cover	SMU	Old Growth
DR/NV				
Dead/Damaged	71,800	3,300	9,800	100
Green	82,100	0	0	400
Subtotal	153,900	3,300	9,800	500
DR/TM				
Dead/Damaged	23,400	4,600	900	2,600
Green	65,000	0	0	4,600
Subtotal	88,400	4,600	900	7,200
Forage				
Dead/Damaged	44,800	300	9,800	200
Green	20,100	0	0	100
Subtotal	64,900	300	9,800	300
Total for Alternative G				
Dead/Damaged	140,000	8,200	20,500	2,900
Green	167,200	0	0	5,100
Subtotal	307,200	8,200	20,500	8,000

ALTERNATIVE H CMP Allocation	Total	Sat. Cover	SMU	Old Growth
DR/NV				
Dead/Damaged	71,900	3,300	9,800	100
Green	82,100	0	0	400
Subtotal	154,000	3,300	9,800	500
DR/TM				
Dead/Damaged	44,100	4,600	1,300	4,100
Green	65,000	0	0	4,600
Subtotal	109,100	4,600	1,300	8,700
Forage				
Dead/Damaged	48,200	300	10,200	200
Green	20,100	0	0	100
Subtotal	68,300	300	10,200	300
Total for Alternative H				
Dead/Damaged	164,200	8,200	21,300	4,400
Green	167,200	0	0	5,100
Subtotal	331,400	8,200	21,300	9,500

ALTERNATIVE J CMP Allocation	Total	Sat. Cover	SMU	Old Growth
DR/NV				
Dead/Damaged	71,800	3,300	9,800	100
Green	82,100	0	0	400
Subtotal	153,900	3,300	9,800	500
DR/TM				
Dead/Damaged	26,800	4,700	1,000	2,600
Green	65,000	0	0	4,600
Subtotal	91,800	4,700	1,000	7,200
Forage				
Dead/Damaged	47,900	300	10,100	200
Green	20,100	0	0	100
Subtotal	68,000	300	10,100	300
Total for Alternative J				
Dead/Damaged	146,500	8,300	20,900	2,900
Green	167,200	0	0	5,100
Subtotal	313,700	8,300	20,900	8,000

Note: Volumes will vary slightly from other reports due to differences in computer queries and GIS layers used. These volumes were derived from the harvest layer subunits and the post-fire mortality cover II layer. Volume for dead timber was reduced for checking and loss of volume in top log. Volumes within the Cover, OG, SMU categories are not exclusive. The same area may appear in all three classifications due to the way in which the PMC layer was developed.

Figure G-14
Acres of Untreated Areas Remaining Following Harvest

ALTERNATIVE G CMP Allocation	Total	Sat. Cover	SMU	Old Growth
DR/NV	9,564	654	1,289	25
DR/TM	3,873	1,007	102	331
Forage	4,523	136	752	17
Total	17,942	1,797	2,143	374

ALTERNATIVE H CMP Allocation	Total	Sat. Cover	SMU	Old Growth
DR/NV	9,566	654	1,289	28
DR/TM	6,066	1,079	134	455
Forage	4,586	136	756	18
Total	20,219	1,869	2,179	502

ALTERNATIVE J CMP Allocation	Total	Sat. Cover	SMU	Old Growth
DR/NV	9,571	654	1,289	28
DR/TM	7,069	1,113	176	568
Forage	4,889	136	786	20
Total	21,529	1,903	2,251	616

Note: Acres will vary slightly from other reports due to differences in computer queries and GIS layers used. These acres were derived from the Harvest layer subunits and the post fire mortality cover II layer. The acres in satisfactory cover, SMU, and Old Growth are not exclusive. That is, acres within each strategy may also be the same acres in another strategy due to the way the cover layer was developed.

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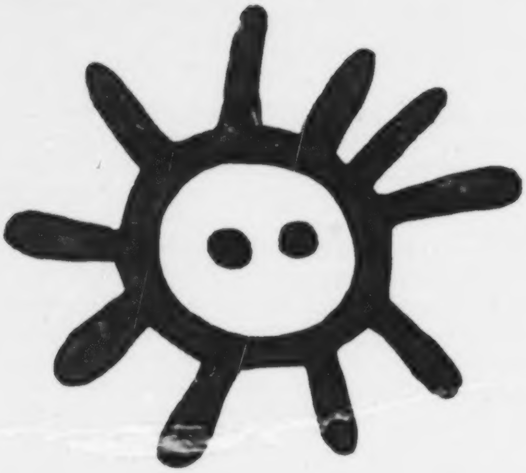

APPENDIX H

RESOURCE PROJECTS

RECREATION, WATERSHED, WILDLIFE, AND CULTURAL RESOURCE PROJECTS

TEPEE BUTTE FIRE RECOVERY PROJECT
By
Tom Glassford, Recreation Specialist
Kenwood Hauter, Hydrologist
Rich Thurman, Wildlife Biologist
Jeffery B. Walker, Archaeologist

Appendix H contains detailed descriptions of the recreation, watershed, wildlife, and cultural resource projects which are proposed in Chapter II of the Draft EIS. This Appendix is composed of four sections: Recreation Feature Prescriptions, Watershed Projects, Wildlife projects, and Cultural Resource Projects.

The Recreation Features Prescriptions describe the present condition of each recreation site with respect to access, facilities, and vegetation. These prescriptions provide for different levels of recovery, by alternative, for each site. The cost of each recovery package is also estimated for each site. Estimates include the cost of materials, labor, and equipment. They do not include the administrative or mobilization costs associated with contracting and moving heavy equipment to and from the sites. Costs will vary, depending on the number and location of the sites selected for recovery in the Final EIS.

The Watershed Projects provide for re-establishment of riparian shrubs near perennial streams. They are not mitigating measures and are not designed to counteract any negative effects expected as a result of implementing the action alternatives. These projects are proposals to facilitate rapid recovery from the effects of the fire.

Wildlife Projects are proposed under all action alternatives. Nesting platforms and nest boxes are proposed to concentrate populations of raptors in areas adjacent to high-intensity burn sites to control rodent populations. The Frog Pond Wildlife Area will encompass approximately five acres. This area will increase wildlife use while maintaining a livestock watering source.

The Cultural Resource Projects describe proposals which are not directly related to other resources. Under all action alternatives, proposed projects include additional documentation, monitoring and surveillance, testing and evaluation, and some data recovery.

RECREATION FEATURE PRESCRIPTIONS

NAME OF FEATURE: Buckhorn Lookout (Administrative Facility)

Legal Location: T3N / R48E / S9 / SE
Access Route: Roads 46 / 4600780 / 4600810
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Features include a lookout station, storage shed, signing, and parking barriers. Fire suppression activity caused no damage to the facilities, structures, or vegetation. Since Road 810 was used as a staging area, there was light impact to the road.

Pre-fire Recovery (Alternative G) **Cost:** $ 200

Manage as an administrative fire facility. Retain present access with signing. Rehabilitate soil displaced on Road 810 caused by vehicle staging.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 200

Moderate enhancement includes the recovery described in Alternative G.

Maximum Enhancement (Alternative I) **Cost:** $ 400

Maximum enhancement includes the recovery described in Alternatives G, H, and J, establishment of an interpretive site as described in the CMP, and sign the intersection of Roads 46/780 and 780/810.

NAME OF FEATURE: Buckhorn Spring Campground (Developed Campground)

Legal Location: T3N / R48E / S8 / NE
Access Route: Roads 46 / 4600780 / 4600783
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Features include six developed campsites, a developed water source with an exclosure, two toilets, signing, parking barriers, fencing, and a stock ramp. Tractor operations associated with fire suppression caused light soil displacement on Roads 780/783 and moderate soil displacement in the campground. Other suppression activity caused light damage to vegetation. Some trees around the campground have fallen.

Pre-fire Recovery (Alternative G) **Cost:** $ 2,300

Manage as a developed campground with a developed water source that will be tested and monitored for human use. Retain present access with signing. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Salvage hazard trees around the campground; flush-cut all stumps. Rehabilitate soil displaced by tractor operations on Roads 780/783 and around the campground. Clear campground of fallen trees. Repair the spring box and exclosure. Seed or plant around the campground to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 2,500

Moderate enhancement includes the recovery described in Alternative G. Remove the stock ramp and clean up the area.

Maximum Enhancement (Alternative I) **Cost:** $ 2,600

Maximum enhancement includes the recovery described in Alternatives G, H, and J. Extend the six camp spurs, and improve circulation of traffic in the campground.

NAME OF FEATURE: Buckhorn Ridge Hunter Camp (Dispersed Campsite)

Legal Location: T3N / R48E / S9 / NE
Access Route: Roads 46 / 4600780
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Features include dispersed campsites and a pond. Tractor operations associated with fire suppression caused moderate soil displacement near the pond and extensive soil displacement on a tractor line that extends one-half mile northwest of the camp. Other suppression activity caused light damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 1,000

Manage as a dispersed camping area with a livestock water source. Retain present access without signing. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Salvage hazard trees around the camping area; flush-cut all stumps. Rehabilitate soil displaced by tractor operations near the pond and on one-half mile of tractor line. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 1,000

Moderate enhancement includes the recovery described in Alternative G.

Maximum Enhancement (Alternative I) **Cost:** $ 3,000

Maximum enhancement includes the recovery described in Alternatives G, H, and J. Manage as a dispersed campsite with livestock emphasis. Construct a loading ramp and two hitchracks. Improve Road 780 by rocking it to firm up soil for fall use. Place log or rock barriers for vehicle management.

NAME OF FEATURE: Cherry Creek Hunter Camp (Dispersed Campsite)

Legal Location: T4N / R48E / S8 / SE
Access Route: Roads 46 / 4600780 / 4600788
Resource Allocation: DR/NV ROS Class: SPM VQO: PR

Features include dispersed campsites. The fire caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 300

Manage as a dispersed camping area and retain present access without signing. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Salvage hazard trees around the camping area; flush-cut all stumps. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 300

Moderate enhancement includes the recovery described in Alternative G.

Maximum Enhancement (Alternative I) **Cost:** $ 300

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Cold Spring Junction Hunter Camp (Dispersed Campsite)

Legal Location: T4N / R47E / S22 / SW
Access Route: Roads 46 / 4680
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Features include dispersed campsites, corral with chute, and a tent frame. Tractor operations associated with fire suppression caused extensive soil displacement by a tractor line around the corral. Other suppression activity caused light damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 400

Manage as a dispersed camping area. Retain present access without signing. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Salvage hazard trees around the camping area; flush-cut all stumps. Rehabilitate soil displaced by tractor line around the corral. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 400

Moderate enhancement includes the recovery described in Alternative G.

Maximum Enhancement (Alternative I) **Cost:** $ 400

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Cold Spring Ridge Hunter Camp (Dispersed Campsite)

Legal Location: T5N / R47E / S28 / NW
Access Route: Roads 46 / 4680
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Features include dispersed campsites, storage shed, and a corral with chute. The fire partially burned the corral and caused light damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 600

Manage as a dispersed camping area. Retain present access without signing. Maintain vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Repair the corral and chute. Salvage hazard trees around the camping area; flush-cut all stumps. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 600

Moderate enhancement includes the recovery described in Alternative G.

Maximum Enhancement (Alternative I) **Cost:** $ 600

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Cottonwood Creek Hunter Camp (Dispersed Campsite)

Legal Location: T4N / R47E / S21 / NW
Access Route: Roads 46 / 4600670
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Features include dispersed campsites. The fire caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 300

Manage as a dispersed camping area. Retain present access without signing. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Salvage hazard trees around the camping area; flush-cut all stumps. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 300

Moderate enhancement includes the recovery described in Alternative G.

Maximum Enhancement (Alternative I) **Cost:** $ 300

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Deadhorse Junction Hunter Camp (Dispersed Campsite)

Legal Location: T3N / R48E / S5 / SW
Access Route: Roads 46 / 4600760
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Features include dispersed campsites and signing. Tractor operations associated with fire suppression caused moderate soil displacement in the camping area and extensive soil displacement on tractor lines that zigzag into timber for one-half mile along the east side of Road 46. Other suppression activity caused light damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 600

Manage as a dispersed camping area. Retain present access without signing. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Salvage hazard trees around camping area; flush-cut all stumps. Rehabilitate soil displaced by tractor operations in camping area and in the tractor line. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 600

Moderate enhancement includes the recovery described in Alternative G.

Maximum Enhancement (Alternative I) **Cost:** $ 600

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Deadhorse Ridge Hunter Camp (Dispersed Campsite)

Legal Location: T4N / R48E / S30 / NE
Access Route: Roads 46 / 4600670
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Features include dispersed campsites, developed water source with an exclosure, and a pond. The fire caused light damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 1,000

Manage as a dispersed camping area and water source. Retain present access without signing. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Salvage hazard trees around the camping area; flush-cut all stumps. Repair the spring box and exclosure. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 3,500

Moderate enhancement includes the recovery described in Alternative G. Improve the road condition to the water source with coarse-base surfacing to prevent erosion.

Maximum Enhancement (Alternative I) **Cost:** $ 4,300

Maximum enhancement includes the recovery described in Alternatives G, H, and J. Enhance wildlife use of the water source by constructing a buck and rail exclosure.

NAME OF FEATURE: Downey Saddle Hunter Camp (Dispersed Campsite)

Legal Location: T5N / R47E / S16 / NW
Access Route: Roads 46 / 4680
Resource Allocation: DR/NV ROS Class: SPM VQO: PR

Features include dispersed campsites and a water source. The fire moderately damaged the spring box and caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 700

Manage as a dispersed camping area and water source. Retain present access without signing. Maintain vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Remove hazard trees around the camping area; flush-cut all stumps. Repair the spring box. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 2,400

Moderate enhancement includes the recovery described in Alternative G. Expand parking and turnaround for trailers. Construct an exclosure around the water source.

Maximum Enhancement (Alternative I) **Cost:** $ 2,400

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Fairchild Point Hunter Camp (Dispersed Campsite)

Legal Location: T4N / R47E / S17 / SW
Access Route: Roads 46 / 4600625
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Features include dispersed campsites and a developed water source with an exclosure. Tractor operations associated with fire suppression caused moderate soil displacement in camping area and destroyed the water source development. Other suppression activity caused heavy damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 2,100

Manage as a dispersed camping area and water source. Retain present access without signing. Maintain vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Salvage hazard trees in camping area; flush-cut all stumps. Rehabilitate soil displaced by tractor operations in camping area. Repair the spring box and exclosure. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 2,100

Moderate enhancement includes the recovery described in Alternative G.

Maximum Enhancement (Alternative I) **Cost:** $ 2,100

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Wildhorse Ridge Hunter Camp (Dispersed Campsite)

Legal Location: T5N / R46E / S23 / SE
Access Route: Roads 46 / 4600595 / 4600596 / 4600598
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Features include dispersed campsites, a salt shack, and a corral. Tractor operations associated with fire suppression caused extensive soil displacement on a tractor line that extends approximately one-quarter of a mile from the end of Road 596. Suppression activities caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 700

Manage as a dispersed camping area. Retain present access without signing. Maintain vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Salvage hazard trees around camping area; flush-cut all stumps. Rehabilitate soil displaced in the tractor line. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 700

Moderate enhancement includes the recovery described in Alternative G. Limit present access, and restrict vehicle access for wildlife values.

Maximum Enhancement (Alternative I) **Cost:** $ 700

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Wellamotkin Corridor Hunter Camps (Dispersed Campsites)

Legal Location: Variable
Access Route: Road 46
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Features include dispersed campsites. Fire suppression activity caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 4,700

Manage as dispersed camping areas. Retain present access. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Salvage hazard trees around camping areas; flush-cut all stumps. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 4,700

Moderate enhancement includes the recovery described in Alternative G.

Maximum Enhancement (Alternative I) **Cost:** $ 4,700

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Cold Spring Corridor Hunter Camps (Dispersed Campsites)

Legal Location: Variable
Access Route: Roads 46 / 4680
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Features include dispersed campsites. Fire suppression activities caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 2,400

Manage as dispersed camping areas. Retain present access. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Salvage hazard trees around camping areas; flush-cut all stumps. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 2,400

Moderate enhancement includes the recovery described in Alternative G.

Maximum Enhancement (Alternative I) **Cost:** $ 2,400

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Deadhorse Corridor Hunter Camps (Dispersed Campsites)

Legal Location: Variable
Access Route: Roads 46 / 4600760
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Features include dispersed campsites. Fire suppression activities caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost: $ 2,100**

Manage as dispersed camping areas. Retain present access. Maintain vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Salvage hazard trees around camping areas; flush-cut all stumps. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost: $ 2,100**

Moderate enhancement includes the recovery described in Alternative G.

Maximum Enhancement (Alternative I) **Cost: $ 2,100**

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Wildhorse Corridor Hunter Camps (Dispersed Campsites)

Legal Location: Variable
Access Route: Roads 46 / 4600596
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Features include dispersed campsites. Fire suppression activities caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost: $ 2,100**

Manage as dispersed camping areas. Retain present access. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Salvage hazard trees around camping areas; flush-cut all stumps. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost: $ 2,100**

Moderate enhancement includes the recovery described in Alternative G.

Maximum Enhancement (Alternative I) **Cost: $ 2,100**

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Box Spring (Water Source)

Legal Location: T4N / R47E / S21 / NE
Access Route: Roads 46 / 4600670
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Feature is a developed water source with an exclosure. Tractor operations associated with fire suppression destroyed the water source development and caused extensive soil displacement on a tractor line through the draw. Other suppression activity caused moderate damage to vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 1,500

Manage as a dispersed recreational water source. Retain present access without signing. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Reconstruct the spring box and rustic exclosure. Rehabilitate soil displaced by tractor operations around the water source. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 1,500

Moderate enhancement includes recovery described in Alternatives G, H, and J.

Maximum Enhancement (Alternative I) **Cost:** $ 1,500

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Buckhorn Spring (Water Source)

Legal Location: T3N / R48E / S9 / NW
Access Route: Roads 46 / 4600780 / 4600783
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Feature is a developed water source with an exclosure. The fire moderately damaged the spring box and exclosure.

Pre-fire Recovery (Alternative G) **Cost:** $ 1,500

Manage as a dispersed recreational water source. Retain present access without signing. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Repair the spring box and rustic exclosure.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 1,500

Moderate enhancement includes the recovery described in Alternative G.

Maximum Enhancement (Alternative I) **Cost:** $ 1,500

Maximum enhancement includes the described in Alternatives G, H, and J.

NAME OF FEATURE: Cottonwood Spring (Water Source)

Legal Location: T4N / R47E / S21 / NW
Access Route: Roads 46 / 4600670
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Feature is a developed water source. Fire destroyed the spring development and caused heavy damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 1,200

Manage as a dispersed recreational water source. Retain present access without signing. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Reconstruct the spring box. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 2,000

Moderate enhancement includes the recovery described in Alternative G. Construct a rustic exclosure around the water source.

Maximum Enhancement (Alternative I) **Cost:** $ 2,000

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Deadhorse Spring (Water Source)

Legal Location: T4N / R48E / S30 / NE
Access Route: Roads 46 / 4600760
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Feature is a developed water source with an exclosure. The fire moderately damaged the spring box and exclosure and caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 1,500

Manage as a dispersed recreational water source. Retain present access without signing. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Repair the spring box and rustic exclosure. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 1,500

Moderate enhancement includes the recovery described in Alternative G.

Maximum Enhancement (Alternative I) **Cost:** $ 1,500

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Downey Spring (Water Source)

Legal Location: T5N / R47E / S16 / NW
Access Route: Roads 46 / 4680
Resource Allocation: DR/NV ROS Class: SPM VQO: PR

Feature is a developed water source. The fire moderately damaged the spring box and caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 650

Manage as a dispersed recreational water source. Retain present access without signing. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Repair the spring box. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 1,450

Moderate enhancement includes the recovery described in Alternative G. Construct a rustic exclosure around the water source.

Maximum Enhancement (Alternative I) **Cost:** $ 1,450

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Fairchild Spring (Water Source)

Legal Location: T4N / R47E / S17 / SW
Access Route: Roads 46 / 4600625
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Feature is a developed water source with an exclosure. Tractor operations associated with fire suppression destroyed the spring development. The fire caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 1,500

Manage as a dispersed recreational water source. Retain present access without signing. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Reconstruct the spring box and rustic exclosure. Rehabilitate soil displaced by tractor operations around the water source. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 1,500

Moderate enhancement includes the recovery described in Alternative G.

Maximum Enhancement (Alternative I) **Cost:** $ 1,500

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Frog Pond (Water Source)

Legal Location: T5N / R47E / S28 / SW
Access Route: Roads 46 / 4680
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Feature is a spring-fed pond. Fire suppression activity caused dredging the pond. Fire caused light damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost: $ 500**

Manage as a wildlife water source. Retain present access without signing. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Contour and seed the sediment berm dredged from the pond.

Moderate Enhancement (Alternatives H & J) **Cost: $ 2,900**

Moderate enhancement includes the recovery described in Alternative G. Construct a livestock exclosure with a buck and rail fence for vegetative recovery and small game. Allow livestock access from one angle of the pond.

Maximum Enhancement (Alternative I) **Cost: $ 3,200**

Maximum enhancement includes the recovery described in Alternatives G, H, and J. Plant willows, aspen, and huckleberry.

NAME OF FEATURE: Old Cold Spring (Water Source)

Legal Location: T5N / R47E / S21 / SW
Access Route: Roads 46 / 4680 / 4680170
Resource Allocation: DR/NV ROS Class: SPNM VQO: R

Features include a developed water source and a fenced pasture. The fire caused access Road 170 to be blocked by fallen timber and heavy damage to vegetation.

Pre-fire Recovery (Alternative G) **Cost: $ 1,000**

Manage as a dispersed water source. Retain present access without signing. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Clear Road 170 of fallen timber and hazard trees. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost: $ 1,200**

Moderate enhancement includes the recovery described in Alternative G.

Maximum Enhancement (Alternative I) **Cost: $ 1,200**

Maximum enhancement includes recovery described in Alternatives G, H, and J.

NAME OF FEATURE: Bear Flat (Interpretive Viewpoint)

Legal Location: T5N / R46E / S25 / SE
Access Route: Roads 46 / 4600596
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Feature has potential as an interpretive viewpoint.

Pre-fire Recovery (Alternative G) **Cost:** $ 0

None.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 0

None.

Maximum Enhancement (Alternative I) **Cost:** $ 200

Establish as an interpretive viewpoint with interpretive signing. Place log or rock barriers for vehicle management.

NAME OF FEATURE: Buckhorn Lookout (Interpretive Viewpoint)

Legal Location: T3N / R48E / S9 / SE
Access Route: Roads 46 / 4600780 / 4600810
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Features include a lookout station, storage shed, signing, and parking barriers. Feature has potential as an interpretive viewpoint.

Pre-fire Recovery (Alternative G) **Cost:** $ 0

None.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 0

None.

Maximum Enhancement (Alternative I) **Cost:** $ 400

Establish as an interpretive viewpoint with interpretive signing as described in the CMP. Sign the intersection of Roads 46/780 and 780/810.

NAME OF FEATURE: Cemetery Ridge Lookout (Interpretive Viewpoint)

Legal Location: T3N / R48E / S3 / NW
Access Route: Roads 46 / 4600780 / 4600820 / Non-system spur
Resource Allocation: DR/NV ROS Class: SPNM VQO: R

Features include remains of a lookout and has potential as an interpretive viewpoint.

Pre-fire Recovery (Alternative G) **Cost: $ 0**

None.

Moderate Enhancement (Alternatives H & J) **Cost: $ 3,900**

Establish as an interpretive viewpoint. Construct a spur access trail to the site from the road. Construct a interpretive bulletin board at the site.

Maximum Enhancement (Alternative I) **Cost: $ 3,900**

Maximum enhancement includes recovery described in Alternatives H and J.

NAME OF FEATURE: Cold Spring / Cottonwood Creek (Interpretive Viewpoint)

Legal Location: T5N / R47E / S20 / SE
Access Route: Roads 46 / 4680
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Feature has potential as an interpretive viewpoint.

Pre-fire Recovery (Alternative G) **Cost: $ 0**

None.

Moderate Enhancement (Alternatives H & J) **Cost: $ 0**

None.

Maximum Enhancement (Alternative I) **Cost: $ 700**

Establish as an interpretive viewpoint with interpretive signing. Place log or rock barriers for vehicle management.

NAME OF FEATURE: Cold Spring / Cook Creek (Interpretive Viewpoint)

Legal Location: T4N / R47E / S3 / NW
Access Route: Roads 46 / 4680 / 4680110
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Feature has potential as an interpretive viewpoint.

Pre-fire Recovery (Alternative G) **Cost: $ 0**

None.

Moderate Enhancement (Alternatives H & J) **Cost: $ 900**

Establish as an interpretive viewpoint with interpretive signing. Place log or rock barriers for vehicle management. Sign 46/4680 Road junction.

Maximum Enhancement (Alternative I) **Cost: $ 900**

Maximum enhancement includes recovery described in Alternatives H and J.

NAME OF FEATURE: Deadhorse Butte (Interpretive Viewpoint)

Legal Location: T4N / R48E / S19 / SW
Access Route: Roads 46 / 4600760 / Trail 1719
Resource Allocation: DR/NV ROS Class: SPNM VQO: R

Feature has potential as an interpretive viewpoint.

Pre-fire Recovery (Alternative G) **Cost: $ 0**

None.

Moderate Enhancement (Alternatives H & J) **Cost: $ 200**

Establish as an interpretive viewpoint with interpretive signing.

Maximum Enhancement (Alternative I) **Cost: $ 200**

Maximum enhancement includes recovery described in Alternatives H and J.

NAME OF FEATURE: Fairchild Lookout (Interpretive Viewpoint)

Legal Location: T4N / R47E / S17 / NW
Access Route: Roads 46 / 4600613
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Features include remains of the lookout. Feature has potential as an interpretive viewpoint.

Pre-fire Recovery (Alternative G) **Cost: $ 0**

None.

Moderate Enhancement (Alternatives H & J) **Cost: $ 700**

Establish as an interpretive viewpoint with interpretive signing. Place log or rock barriers for vehicle management.

Maximum Enhancement (Alternative I) **Cost: $ 700**

Maximum enhancement includes recovery described in Alternatives H and J.

NAME OF FEATURE: Frog Pond (Interpretive Viewpoint)

Legal Location: T5N / R47E / S28 / SW
Access Route: Roads 46 / 4680
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Feature is a spring-fed pond. Feature has potential as an interpretive viewpoint.

Pre-fire Recovery (Alternative G) **Cost: $ 0**

None.

Moderate Enhancement (Alternatives H & J) **Cost: $ 2,400**

Establish as an interpretive viewpoint with interpretive signing. Place log or rock barriers for vehicle management. Construct a livestock exclosure with a buck and rail fence for vegetative recovery and small game.

Maximum Enhancement (Alternative I) **Cost: $ 2,700**

Maximum enhancement includes the recovery described in Alternatives H and J. Plant willows, aspen, and huckleberry.

NAME OF FEATURE: Wildhorse Ridge (Interpretive Viewpoint)

Legal Location: T5N / R46E / S23 / SE
Access Route: Roads 46 / 4600595 / 4600596
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Feature has potential as an interpretive viewpoint.

Pre-fire Recovery (Alternative G) **Cost: $ 0**

None.

Moderate Enhancement (Alternatives H & J) **Cost: $ 0**

None.

Maximum Enhancement (Alternative I) **Cost: $ 700**

Establish as an interpretive viewpoint with interpretive signing. Place log or rock barriers for vehicle management.

NAME OF FEATURE: Cemetery Ridge Trailhead (1731)

Legal Location: T4N / R48E / S27 / SW
Access Route: Roads 46 / 4600780 / 4600820
Resource Allocation: DR/NV ROS Class: SPNM VQO: R

Feature has no facilities. The fire caused heavy damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 300

Manage as a recreation trailhead with a dispersed camping area. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 3,300

Moderate enhancement includes seeding or planting in Alternative G. Relocate and consolidate trailhead with Eureka Creek Trailhead to T3N / R48E / S4 / SE. Manage as a recreation trailhead. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Provide parking, signing, hitchracks, and stock ramp.

Maximum Enhancement (Alternative I) **Cost:** $ 12,300

Maximum enhancement includes the recovery described in Alternatives H and J. Provide a vault toilet and bulletin board.

NAME OF FEATURE: Chalk Creek Trailhead (1702)

Legal Location: T4N / R48E / S8 / NE
Access Route: Roads 46 / 4600780 / 4600788
Resource Allocation: DR/NV ROS Class: SPM VQO: PR

Feature has no facilities. The fire caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 300

Manage as a recreation trailhead. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 3,300

Moderate enhancement includes the seeding or planting in Alternative G. Relocate and consolidate trailhead with Cherry Creek Trailhead to T4N / R48E / S8 / SE. Manage as a recreation trailhead. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Provide parking, signing, hitchracks, and stock ramp.

Maximum Enhancement (Alternative I) **Cost: $12,300**

Maximum enhancement includes the recovery described in Alternatives H and J. Provide a vault toilet and bulletin board.

NAME OF FEATURE: Cherry Creek Trailhead (1705)

Legal Location: T4N / R48E / S8 / NE
Access Route: Roads 46 / 4600780 / 4600788
Resource Allocation: DR/NV ROS Class: SPM VQO: PR

Feature has no facilities. The fire caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost: $ 300**

Manage as a recreation trailhead. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost: $ 3,300**

Moderate enhancement includes the seeding or planting in Alternative G. Relocate and consolidate trailhead with Chalk Creek Trailhead to T4N / R48E / S8 / SE. Manage as a recreation trailhead. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Provide parking, signing, hitchracks, and stock ramp.

Maximum Enhancement (Alternative I) **Cost: $12,300**

Maximum enhancement includes the recovery described in Alternatives H and J. Provide a vault toilet and bulletin board.

NAME OF FEATURE: Cook Creek Trailhead (1697)

Legal Location: T4N / R48E / S30 / SE
Access Route: Roads 46 / 4600760
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Feature has no facilities. The fire caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost: $ 300**

Manage as a recreation trailhead with a dispersed camping area. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site.

Maintain sufficient stand density to screen the site from adjacent travel corridors. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 3,300

Moderate enhancement includes the seeding or planting in Alternative G. Relocate and consolidate trailhead with Old Man Creek Trailhead to T4N / R48E / S30 / NE. Manage as a recreation trailhead. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Provide parking, signing, hitchracks, and stock ramp.

Maximum Enhancement (Alternative I) **Cost:** $12,300

Maximum enhancement includes recovery described in Alternatives H and J. Provide a vault toilet and bulletin board.

NAME OF FEATURE: Cottonwood Creek Trailhead (1696)

Legal Location: T4N / R47E / S21 / NW
Access Route: Roads 46 / 4600670
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Feature has no facilities. The fire caused heavy damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 300

Manage as a recreation trailhead. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 2,700

Moderate enhancement includes the seeding or planting in Alternative G. Relocate trailhead to T4N / R47E / S21 / NW (0.2 miles from existing trailhead). Manage as a recreation trailhead. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Provide parking, signing, hitchracks, and stock ramp.

Maximum Enhancement (Alternative I) **Cost:** $11,700

Maximum enhancement includes the recovery described in Alternatives H and J. Provide a vault toilet and bulletin board.

NAME OF FEATURE: Deadhorse Creek Trailhead (1708)

Legal Location. T5N / R47E / S29 / NE
Access Route: Roads 46 / 4680 / 4680150
Resource Allocation: Forage ROS Class: SPNM VQO: R

Feature has no facilities. The fire caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 300

Manage as a recreation trailhead with a dispersed camping area. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 3,300

Moderate enhancement includes the seeding or planting in Alternative G. Relocate and consolidate trailhead with Dry Creek Trailhead to T4N / R47E / S21 / NW. Manage as a recreation trailhead. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Provide parking, signing, hitchracks, and stock ramp.

Maximum Enhancement (Alternative I) **Cost:** $12,300

Maximum enhancement includes recovery described in Alternatives H and J. Provide a vault toilet and bulletin board.

NAME OF FEATURE: Dry Creek Trailhead (1704)

Legal Location: T5N / R47E / S28 / SW
Access Route: Roads 46./ 4680
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Feature has no facilities. The fire caused light damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 300

Manage as a recreation trailhead with a dispersed camping area. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 3,300

Moderate enhancement includes the seeding or planting in Alternative G. Relocate and consolidate trailhead with Deadhorse Creek Trailhead to T5N / R47E / S28 / SW (0.2 miles from existing trailhead). Manage as a recreation trailhead. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site.

Maintain sufficient stand density to screen the site from adjacent travel corridors. Provide parking, signing, hitchracks, and stock ramp.

Maximum Enhancement (Alternative I) **Cost:** $12,300

Maximum enhancement includes the recovery described in Alternatives H and J. Provide a vault toilet and bulletin board.

NAME OF FEATURE: Eureka Creek Trailhead (1732)

Legal Location: T3N / R48E / S3 / NW
Access Route: Roads 46 / 4600780
Resource Allocation: DR/NV ROS Class: SPNM VQO: R

Feature has no facilities. The fire caused light damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 300

Manage as a recreation trailhead with a dispersed camping area. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 3,300

Moderate enhancement includes the seeding or planting in Alternative G. Relocate and consolidate trailhead with Cemetery Creek Trailhead to T3N / R48E / S4 / SE. Manage as a recreation trailhead. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Provide parking, signing, hitchracks, and stock ramp.

Maximum Enhancement (Alternative I) **Cost:** $12,300

Maximum enhancement includes the recovery described in Alternatives H and J. Provide a vault toilet and bulletin board.

NAME OF FEATURE: Five Points Creek Trailhead (1697A)

Legal Location: T4N / R47E / S15 / SW
Access Route: Roads 46 / 4680
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Feature has no facilities. The fire caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost: $ 300**

Manage as a recreation trailhead. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost: $ 2,700**

Moderate enhancement includes the seeding or planting in Alternative G. Relocate trailhead to T4N / R47E / S15 / SE. Manage as a recreation trailhead. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Provide parking, signing, hitchracks, and stock ramp.

Maximum Enhancement (Alternative I) **Cost: $11,700**

Maximum enhancement includes recovery described in Alternatives H and J. Provide a vault toilet and bulletin board.

NAME OF FEATURE: Howard Cutoff Trailhead

Legal Location: T4N / R47E / S17 / NW
Access Route: Roads 46 / 4600613
Resource Allocation: DR/TM ROS Class: RN VQO: PR

Feature has no facilities. The fire caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost: $ 0**

None.

Moderate Enhancement (Alternatives H & J) **Cost: $ 0**

None.

Maximum Enhancement (Alternative I) **Cost: $11,400**

Manage as a recreation trailhead. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Provide parking, signing, hitchracks, stock ramp, toilet, and bulletin board.

NAME OF FEATURE: Imnaha Breaks Trailhead (1713.1)

Legal Location: T4N / R48E / S16 / SW
Access Route: Roads 46 / 4600780 / 4600788
Resource Allocation: DR/NV ROS Class: SPM VQO: PR

Feature has no facilities. The fire caused light damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 300

Manage as a recreation trailhead. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 2,700

Moderate enhancement includes the seeding or planting in Alternative G. Relocate trailhead to T4N / R48E / S16 / SW (0.2 miles from existing trailhead). Manage as a recreation trailhead. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Provide parking, signing, hitchracks, and stock ramp.

Maximum Enhancement (Alternative I) **Cost:** $11,700

Maximum enhancement includes recovery described in Alternatives H and J. Provide a vault toilet and bulletin board.

NAME OF FEATURE: Old Man Creek Trailhead (1719)

Legal Location: T4N / R48E / S19 / NW
Access Route: Roads 46 / 4600760
Resource Allocation: DR/NV ROS Class: SPNM VQO: R

Feature has no facilities. The fire caused moderate damage to the vegetation.

Pre-fire Recovery (Alternative G) **Cost:** $ 300

Manage as a recreation trailhead with a dispersed camping area. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Seed or plant to prevent resource deterioration.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 3,300

Moderate enhancement includes the seeding or planting in Alternative G. Relocate and consolidate trailhead with Cook Creek Trailhead to T4N / R48E / S30 / NE. Manage as a recreation trailhead. Maintain the vegetative framing and timber canopy that defines the integrity of the overall site. Maintain sufficient stand density to screen the site from adjacent travel corridors. Provide parking, signing, hitchracks, and stock ramp.

Maximum Enhancement (Alternative I) **Cost:** $12,300

Maximum enhancement includes recovery described in Alternatives H and J. Provide a vault toilet and bulletin board.

NAME OF FEATURE: Cemetery Ridge Trail (1731)

Trailhead Legal Location: T4N / R48E / S27 / SW
Trail Terminus Legal Location: T4N / R48E / S16 / SE

Cemetery Ridge Trail extends 2.8 miles. The trail follows Cemetery Ridge and connects with Trail 1713.1. The fire burned lightly along the trail corridor.

Pre-fire Recovery (Alternative G) **Cost:** $ 7,300

Return the trail to pre-fire condition by heavy maintenance, rocking, hazard tree removal, and spot reconstruction. There are 0.6 miles of heavy maintenance, 2.5 miles of rocking, 2.5 miles of light hazard tree removal, and 0.3 miles of reconstruction.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 7,300

Meet trail management objectives by heavy maintenance, rocking, and segment reconstruction. There are 0.6 miles of heavy maintenance, 2.5 miles of rocking, and 0.3 miles of reconstruction.

Maximum Enhancement (Alternative I) **Cost:** $11,200

Meet trail management objectives by heavy maintenance, rocking, hazard tree removal, and segment reconstruction. There are 0.6 miles of heavy maintenance, 2.5 miles of rocking, 2.5 miles of light hazard tree removal, and 0.3 miles of reconstruction. Construct an interpretive spur trail to Cemetery Ridge Lookout.

NAME OF FEATURE: Chalk Creek Trail (1702)

Trailhead Legal Location: T4N / R48E / S8 / NE
Trail Terminus Legal Location: T4N / R48E / S3 / NE

Chalk Creek Trail extends 6.0 miles. The trail extends west above Cherry Creek for 3 miles, and then drops into the Snake River. The fire burned lightly along the trail corridor.

Pre-fire Recovery (Alternative G) **Cost:** $14,700

Return the trail to pre-fire condition by heavy maintenance, rocking, hazard tree removal, and spot reconstruction. There are 5.4 miles of heavy maintenance, 5.4

miles of rocking, 5.4 miles of light hazard tree removal, and 0.6 miles of reconstruction.

Moderate Enhancement (Alternatives H & J) **Cost:** $26,500

Meet trail management objectives by heavy maintenance, rocking, and segment reconstruction. There are 5.4 miles of heavy maintenance, 5.4 miles of rocking, 0.6 miles of reconstruction, and 0.5 miles of trail construction to new trailhead.

Maximum Enhancement (Alternative I) **Cost:** $26,600

Meet trail management objectives by heavy maintenance, hazard tree removal, and segment reconstruction. There are 5.4 miles of heavy maintenance, 5.4 miles of rocking, 5.4 miles of light hazard tree removal, 0.6 miles of reconstruction, and 0.5 miles of trail construction to new trailhead.

NAME OF FEATURE: Cherry Creek Trail (1705)

Trailhead Legal Location: T4N / R48E / S8 / NE
Trail Terminus Legal Location: T5N / R47E / S23 / SE

Cherry Creek Trail extends 6.0 miles. The fire burned lightly along the trail corridor.

Pre-fire Recovery (Alternative G) **Cost:** $14,700

Return the trail to pre-fire condition by heavy maintenance, rocking, hazard tree removal, and spot reconstruction. There are 2.2 miles of heavy maintenance, 5.4 miles of rocking, 5.4 miles of light hazard tree removal, and 0.6 miles of reconstruction.

Moderate Enhancement (Alternatives H & J) **Cost:** $38,400

Meet trail management objectives by heavy maintenance, rocking, and segment reconstruction. There are 2.2 miles of heavy maintenance, 4.4 miles of rocking, and 1.6 miles of reconstruction.

Maximum Enhancement (Alternative I) **Cost:** $38,500

Meet trail management objectives by heavy maintenance, rocking, hazard tree removal, and segment reconstruction. There are 2.2 miles of heavy maintenance, 4.4 miles of rocking, 4.4 miles of light hazard tree removal, and 1.6 miles of reconstruction.

NAME OF FEATURE: Cook Creek Trail (1697)

Trailhead Legal Location: T4N / R48E / S30 / SE
Trail Terminus Legal Location: T5N / R47E / S25 / SE

Cook Creek Trail extends 8.3 miles. The trail follows Cook Creek and connects with Trail 1705. The fire burned heavily to moderately along the trail corridor.

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Pre-fire Recovery (Alternative G) **Cost: $21,300**

Return the trail to pre-fire condition by heavy maintenance, rocking, hazard tree removal, and spot reconstruction. There are 5.6 miles of heavy maintenance, 7.5 miles of rocking, 7.5 miles of heavy hazard tree removal (salvage hazard trees larger than 24" DBH), and 0.8 miles of reconstruction.

Moderate Enhancement (Alternatives H & J) **Cost: $91,000**

Meet trail management objectives by heavy maintenance, rocking, and segment reconstruction. There are 4.5 miles of heavy maintenance, 4.7 miles of rocking, 3.6 miles of reconstruction, and 0.2 miles of trail construction to new trailhead.

Maximum Enhancement (Alternative I) **Cost: $91,900**

Meet trail management objectives by heavy maintenance, rocking, hazard tree removal, and segment reconstruction. There are 4.5 miles of heavy maintenance, 4.7 miles of rocking, 4.7 miles of heavy hazard tree removal (salvage hazard trees larger than 24" DBH), 3.6 miles of reconstruction, and 0.2 miles of trail construction to new trailhead.

NAME OF FEATURE: Cottonwood Creek Trail (1696)

Trailhead Legal Location: T4N / R47E / S21 / NW
Trail Terminus Legal Location: T6N / R46E / S34 / SW

Cottonwood Creek Trail extends 10.0 miles. The trail follows Cottonwood Creek, and enters private land after 6.5 miles. The fire burned heavily to moderately along the trail corridor.

Pre-fire Recovery (Alternative G) **Cost: $25,200**

Return the trail to pre-fire condition by heavy maintenance, rocking, hazard tree removal, and spot reconstruction. There are 5.1 miles of heavy maintenance, 9.0 miles of rocking, 5.1 miles of moderate hazard tree removal (salvage hazard trees larger than 24" DBH), and 1.0 miles of reconstruction.

Moderate Enhancement (Alternatives H & J) **Cost: $43,600**

Meet trail management objectives by heavy maintenance, rocking, and segment reconstruction. There are 5.1 miles of heavy maintenance, 8.3 miles of rocking, 1.7 miles of reconstruction, and 0.1 miles of trail construction to new trailhead.

Maximum Enhancement (Alternative I) **Cost: $44,200**

Meet trail management objectives by heavy maintenance, rocking, hazard tree removal, and segment reconstruction. There are 5.1 miles of heavy maintenance, 8.3 miles of rocking, 5.1 miles of moderate hazard tree removal (salvage hazard trees larger than 24" DBH), 1.7 miles of reconstruction, and 0.1 miles of trail construction to new trailhead.

NAME OF FEATURE: Deadhorse Creek Trail (1708)

Trailhead Legal Location: T5N / R47E / S29 / NE
Trail Terminus Legal Location: T5N / R47E / S30 / NE

Deadhorse Creek Trail extends 1.5 miles. The trail drops into Deadhorse Creek and follows the creek until it connects with Trail 1696. The fire burned heavily the first mile and burned moderately the last half mile along the trail corridor.

Pre-fire Recovery (Alternative G) **Cost:** $ 5,300

Return the trail to pre-fire condition by heavy maintenance, rocking, hazard tree removal, and spot reconstruction. There are 1.3 miles of heavy maintenance, 1.3 miles of rocking, 1.3 miles of moderate hazard tree removal (salvage hazard trees larger than 24" DBH), and 0.2 miles of reconstruction.

Moderate Enhancement (Alternatives H & J) **Cost:** $26,400

Meet trail management objectives by heavy maintenance, rocking, and segment reconstruction. There are 1.0 miles of heavy maintenance, 1.0 miles of rocking, 0.5 miles of reconstruction, and 0.6 miles of trail construction to new trailhead.

Maximum Enhancement (Alternative I) **Cost:** $26,600

Meet trail management objectives by heavy maintenance, rocking, hazard tree removal, and segment reconstruction. There are 1.0 miles of heavy maintenance, 1.0 miles of rocking, 1.0 miles of moderate hazard tree removal (salvage hazard trees larger than 24" DBH), 0.5 miles of reconstruction, and 0.6 miles of trail construction to new trailhead.

NAME OF FEATURE: Dry Creek Trail (1704)

Trailhead Legal Location: T5N / R47E / S28 / SW
Trail Terminus Legal Location: T5N / R47E / S25 / SW

Dry Creek Trail extends 5.0 miles. The trail climbs up Dry Creek Ridge for the first mile, then extends along Dry Creek, and connects with Trail 1697. The fire burned intensely the first 3 miles and moderately the last 2 miles along the trail corridor.

Pre-fire Recovery (Alternative G) **Cost:** $12,600

Return the trail to pre-fire condition by heavy maintenance, rocking, hazard tree removal, and spot reconstruction. There are 2.3 miles of heavy maintenance, 4.5 miles of rocking, 4.3 miles of light hazard tree removal (salvage hazard trees larger than 24" DBH), and 0.5 miles of reconstruction.

Moderate Enhancement (Alternatives H & J) **Cost:** $26,500

Meet trail management objectives by heavy maintenance, rocking, and segment reconstruction. There are 2.3 miles of heavy maintenance, 3.9 miles of rocking, 1.0 miles of reconstruction, and 0.1 miles of trail construction to the new trailhead.

Maximum Enhancement (Alternative I) **Cost: $26,800**

Meet trail management objectives by heavy maintenance, rocking, hazard tree removal, and segment reconstruction. There are 2.3 miles of heavy maintenance, 3.9 miles of rocking, 3.9 miles of light hazard tree removal (salvage hazard trees larger than 24" DBH), 1.0 miles of reconstruction, and 0.1 miles of trail construction to the new trailhead.

NAME OF FEATURE: Eureka Creek Trail (1732)

Trailhead Legal Location: T3N / R48E / S3 / NW
Trail Terminus Legal Location: T4N / R48E / S23 / SW

Eureka Creek Trail extends 5.6 miles. The trail extends along Spain Saddle and then slowly drops into Eureka Creek meeting with the Snake River.

Pre-fire Recovery (Alternative G) **Cost: $14,700**

Return the trail to pre-fire condition by heavy maintenance, rocking, hazard tree removal, and spot reconstruction. There are 2.0 miles of heavy maintenance, 5.0 miles of rocking, 5.0 miles of light hazard tree removal (salvage hazard trees larger than 24" DBH), and 0.6 miles of reconstruction.

Moderate Enhancement (Alternatives H & J) **Cost: $14,600**

Meet trail management objectives by heavy maintenance, rocking, and segment reconstruction. There are 2.0 miles of heavy maintenance, 5.0 miles of rocking, and 0.6 miles of reconstruction.

Maximum Enhancement (Alternative I) **Cost: $15,700**

Meet trail management objectives by heavy maintenance, rocking, hazard tree removal, and segment construction. There are 2.0 miles of heavy maintenance, 5.0 miles of rocking, 5.0 miles of light hazard tree removal (salvage hazard trees larger than 24" DBH), and 0.6 miles of reconstruction. Install interpretive signing at selected points along the trail.

NAME OF FEATURE: Five Points Creek Trail (1697A)

Trailhead Legal Location: T4N / R47E / S15 / SW
Trail Terminus Legal Location: T4N / R47E / S2 / SE

Five Points Creek Trail extends 4.0 miles. The trail follows Five Points Creek and connects with trail 1697. The fire burned lightly to moderately the first mile and burned heavily the last 3 miles of the trail corridor.

Pre-fire Recovery (Alternative G) **Cost: $11,000**

Return the trail to pre-fire condition by heavy maintenance, rocking, hazard tree removal, and spot reconstruction. There are 3.6 miles of heavy maintenance, 3.6

miles of rocking, 3.6 miles of high hazard tree removal (salvage hazard tree larger than 24" DBH), and 0.4 miles of reconstruction.

Moderate Enhancement (Alternatives H & J) **Cost:** $57,400

Meet trail management objectives by heavy maintenance, rocking, and segment reconstruction. There are 1.6 miles of heavy maintenance, 1.6 miles of rocking, 1.9 miles of reconstruction, and 0.5 miles of trail construction to new trailhead.

Maximum Enhancement (Alternative I) **Cost:** $57,700

Meet trail management objectives by heavy maintenance, rocking, hazard tree removal, and segment reconstruction. There are 1.6 miles of heavy maintenance, 1.6 miles of rocking, 1.6 miles of high hazard tree removal (salvage hazard trees larger than 24" DBH), 1.9 miles of reconstruction, and 0.5 miles of trail construction to new trailhead.

NAME OF FEATURE: Howard Cutoff Trail

Trailhead Legal Location: T4N / R47E / S17 / NW
Trail Terminus Legal Location: T4N / R47E / S3 / SW

Howard Cutoff Trail extends 3.1 miles. The trail drops into Cottonwood Creek and climbs to Cold Spring Ridge connecting with Road 4680. The fire burned intensely to moderately along the trail corridor.

Pre-fire Recovery (Alternative G) **Cost:** $ 0

None.

Moderate Enhancement (Alternatives H & J) **Cost:** $ 0

None.

Maximum Enhancement (Alternative I) **Cost:** $73,700

Construct 3.1 miles of interpretive trail.

NAME OF FEATURE: Imnaha Breaks Trail (1713.1)

Trailhead Legal Location: T4N / R48E / S16 / SW
Trail Terminus Legal Location: T4N / R48E / S13 / SW

Imnaha Breaks Trail extends 5.6 miles. The trail drops into Knight Creek, and then into Eureka Creek and dropping into the Snake River. The fire burned lightly along the trail corridor.

Pre-fire Recovery (Alternative G) **Cost: $14,500**

Return the trail to pre-fire condition by heavy maintenance, rocking, hazard tree removal, and spot reconstruction. There are 2.5 miles of heavy maintenance, 5.0 miles of rocking, and 0.6 miles of reconstruction.

Moderate Enhancement (Alternatives H & J) **Cost: $19,200**

Meet trail management objectives by heavy maintenance, rocking, and segment reconstruction. There are 2.5 miles of heavy maintenance, 4.8 miles of rocking, and 0.8 miles of reconstruction.

Maximum Enhancement (Alternative I) **Cost: $19,200**

Meet trail management objectives by heavy maintenance, rocking, hazard tree removal, and segment reconstruction. There are 2.5 miles of heavy maintenance, 4.8 miles of rocking, and 0.8 miles of reconstruction.

NAME OF FEATURE: Old Man Creek Trail (1719)

Trailhead Legal Location: T4N / R48E / S19 / NW
Trail Terminus Legal Location: T4N / R48E / S16 / SW

Old Man Creek extends 3.0 miles. The trail follows Deadhorse Ridge for 1.5 miles and then drops into Old Man Creek connecting with Road 788. The fire burned moderately along the trail corridor.

Pre-fire Recovery (Alternative G) **Cost: $ 8,200**

Return the trail to pre-fire condition by heavy maintenance, rocking, hazard tree removal, and spot reconstruction. There are 2.7 miles of heavy maintenance, 2.7 miles of rocking, 2.7 miles of high hazard tree removal (salvage hazard trees larger than 24" DBH), and 0.3 miles of reconstruction.

Moderate Enhancement (Alternatives H & J) **Cost: $14,800**

Meet trail management objectives by heavy maintenance, rocking, and segment reconstruction. There are 2.4 miles of heavy maintenance, 2.4 miles of rocking, and 0.6 miles of reconstruction.

Maximum Enhancement (Alternative I) **Cost: $15,200**

Meet trail management objectives by heavy maintenance, rocking, hazard tree removal, and segment reconstruction. There are 2.4 miles of heavy maintenance, 2.4 miles of rocking, 2.4 miles of high hazard tree removal (salvage hazard trees larger than 24" DBH), and 0.6 miles of reconstruction.

WATERSHED PROJECTS

The following management activities are common to all of the alternatives except No Action. They are not mitigating measures in that they are not designed to counteract any negative effects expected as a result of implementing the action Alternatives. These projects would achieve the objective of facilitating rapid recovery from the effects of the fire. These common elements relate to the issues identified in Chapter I.

Management activities prescribed by the action alternatives would not reduce riparian shrub density or species composition within riparian management zones (RMZs). BMP 2A, 6A, and 6B, which specify no salvage and tight livestock grazing standards, provide for this outcome. The following activities would efficiently increase riparian shrub shade more quickly than the natural rate.

Riparian shrub survival plots (see Alternative Maps for location)

Prior to establishing riparian shrubs it would be necessary to determine which species can be successfully propagated. Shrub planting is desirable for replacing wildlife habitat, reducing stream temperatures, stabilizing streambanks and providing food for aquatic life by dropping leaves and insects into the stream. Described next is what would be implemented equally under any action alternative, to provide information for successful planting and management of shrubs.

Re-establishing shrubs cost-effectively depends on having answers to three questions:

1. In what areas will shrubs re-sprout naturally?
2. There are some shrubs native to the fire area's Riparian Management Zones (RMZs) that have never been propagated before. Can these be propagated successfully at a nursery to a seedling stage?
3. To what degree will browsing pressure from deer and elk prevent or inhibit the existing or planted shrubs from reaching a desired density?

The answer to question (1), where to plant is already known. Planting would occur in those RMZ areas where fire intensity was hot enough to kill existing riparian and conifer individuals.

For providing an answer to question (2), what riparian shrubs can be successfully propagated to a seedling stage, a contract would be made with a private nursery company. This company would cut shoots of surviving riparian shrubs (especially ones that are prolific seeders), return them to the nursery, and determine which species can be propagated successfully to a seedling stage which would be ready for planting within the project area RMZs.

The following would be performed equally under each action Alternative to provide an answer to question (3). First is the description of a series of test plots, secondly, where along fire area streams the test plots would be located.

Three test plot types would be installed. Each plot would be about 3/4 acre in size.

- The first type would be an area where all browsing pressure by ungulates (deer, elk and livestock) would be prevented. This would be accomplished by installing an 8 foot tall fence. Each fenced-in exclosure would cost about $3,900. Maintenance cost would be about $2,500 over a ten-year period.

These exclosures would be built to include two shrub growth sites. Part of the area would have a high density of surviving riparian shrubs and part of the area would not. The purpose of fencing-in the high density shrubs would be to provide for maximum vigorous growth so that a seed source would be maintained that can supply floated seed for establishing downstream new shrub plants. The low density part of the exclosure would be planted with the propagated native shrub species.

- The second type of test plot would be near the first type. Dead trees would be felled in a jack-strawed pattern for the purpose of substantially eliminating livestock use of the RMZ. Deer and elk use will not be impaired. Within this plot type, propagated seedlings and possibly conifers would be planted. Cost of felling trees would be about $90 for each area.

- The third test plot type would be left open to all grazing animals; trees felled away from the RMZ so they don't fall later and impede animal access. Propagated riparian shrub seedlings and possibly conifers would be planted in this area.

- The cost of planting riparian shrubs for the three areas combined would be about $2800.

- This combination of three test plots closely associated within a single area would allow an assessment of the success of planted riparian shrub seedlings under three levels of grazing animal pressure. The plots would provide information that would be used to determine planting opportunities for areas in addition to what is already planned for each Alternative.

The areas where the set of three test plots would be installed are shown below. Four sets would be installed, two on Cottonwood Creek and two on Cherry Creek. (Cherry Creek's RMZs have not been impacted enough by the fire to require test plots.) Only the upper halves of the streams have plot sets because the downstream halves are expected to have vigorous natural riparian shrub, re-establishment rates. Total cost of 1.2 miles of test plot construction and shrub planting would be about $37,000.

Riparian shrub density change plots (for assessing BMP 6B)

Livestock grazing exclusion plots would be established in key areas within the RMZs of project area streams. These are needed to provide a standard which is ungrazed by livestock to compare to other areas where livestock use is not intentionally restricted, except by BMP 6A. (These plots are not located on Alternative Maps).

These standard assessment plots would be 1/4 to 1/2 acre in size and be about 50 feet wide along the stream within RMZs. Some plots would have low to moderate existing shrub density and some others would have very low or no riparian shrub density. Permanently staked transect lines would be established within them. Livestock exclusion would be provided by felling dead trees in a jack-strawed pattern to a depth of 3 to 4 feet. Deer and elk could still access the riparian shrubs within the plot.

Immediately adjacent to these livestock exclusion plots would be a set of similar permanently staked transect lines that would provide shrub density change within the exclusion plot. Cost for each set of livestock grazed and ungrazed plots would be about $300.

Four sets of riparian shrub density change plots would be installed on each of the three major streams -- Cottonwood, Cook and Cherry Creeks. The total costs for setting up and reading the plots would be about $3600.

Riparian brush planting associated with action alternatives

Alternatives G and I -- Riparian shrubs would initially be planted in riparian management zones (RMZs) according to the following standards:

- Plant in all deer and elk summer and winter range areas on Cottonwood, Cook, and Cherry Creeks.
- Plant in fire areas that had either of the following resulting conditions:
    - areas where riparian vegetation burned at a high intensity
    - areas where conifer vegetation was 70 percent or greater and fire intensity was high or moderate.
- Plant native species with best known probability of success both in terms of becoming initially established and in terms of best resistance to deer and elk browsing pressure.
- Plant at a spacing that would result in an overall low initial density.

Approximately 23 miles of planting areas are shown on Alternative G and I maps. Planting would take place in the fall of 1989 or spring/fall or 1990. The total cost of this planting is expected to be $40,000.

After the results of riparian shrub survival plots become known, a plan would be developed for planting additional native riparian shrubs within the above originally planted areas. Areas considered would be gap areas originally not planted and areas where the original plantings failed due to inappropriate species selection or poor weather conditions. What actually is planted though will depend on the plot results. This could range from 23 miles at $64,000 to 5 miles at $14,000.

Alternatives H and J -- Riparian shrubs would initially be planted in riparian management zones (RMZs) according to the following standards:

- Plant in all deer and elk summer range areas on Cottonwood, Cook and Cherry Creeks.
- Plant in fire areas where the wildfire burned riparian vegetation at a high intensity.
- Plant native species with best known probability of success both in terms of becoming initially established and in terms of best resistance to deer and elk browsing pressure.
- Plant at a spacing that would result in an overall low initial density.

Approximately 2.2 miles of planting areas are shown on Alternative H and J maps. Planting would take place in the Fall 1989 or Spring/Fall 1990. The total cost of this planting is expected to be $4,600.

After the results of riparian shrub survival plots become known, a plan would be developed for planting additional native riparian shrubs within the above originally planted areas as well as within new areas. Within the originally planted area would be the gaps not planted and places where the original plantings failed due to inappropriate species selection or poor weather conditions. What actually is planted though will depend on the plot results. This could range from 23 miles at $64,000 to 5 miles at $14,000.

WILDLIFE PROJECTS

All Action Alternatives

100 LARGE RAPTOR PLATFORMS	X	$35	=	$3500
100 KESTREL NEST BOXES	X	$15	=	$1500
200 SMALL NEST BOXES	X	$4	=	$ 800
MONITORING OF ABOVE			=	$ 800
TOTAL			=	$6600

Alternative G

EXCLOSURE AROUND THE FROG POND ON COLD SPRING RIDGE
5 ACRE BUCK AND POLE WOOD EXCLOSURE = $3000

CULTURAL RESOURCE PROJECTS

Some alternatives propose activities that could adversely affect cultural resources unless mitigation other than avoidance were to be implemented. In those cases where it can be anticipated that a proposed project would impact cultural resources, the costs for monitoring, testing and evaluation, and data recovery are incorporated in the cost estimates for those projects under the respective resource sections. Those estimated costs are not displayed.

In addition to these, there are other activities in which the cultural resource involvement would be administrative or difficult to tie to a specific resource activity. Also, the need for additional documentation of cultural resources beyond the level of inventorying has been identified.

All action alternatives would initiate four cultural resource projects. These are: 1) additional documentation and project monitoring; 2) monitoring of erosion, signing, and surveillance over an extended period of time; 3) a project focusing on Cherry Creek Ranch, and 4) a cambium peeled tree data recovery project. The cost estimates vary by alternatives for most of these projects.

The additional site documentation and monitoring would cost $3,200 under all action alternatives which include necessary documentation beyond the inventory level at selected cultural resource sites, and monitoring of the fireline rehabilitation.

The estimated costs for continued monitoring and surveillance over an extended time frame are approximately $1,000 a year. This would include monitoring the effects of natural erosion and decay, signing to notify the public of penalties for vandalizing cultural resources, and law enforcement surveillance to protect against theft and vandalism.

The Cherry Creek Ranch was destroyed by the fire and clean-up of the rubble is planned. Alternatives G and H would involve monitoring this activity at an estimated cost of $500, assuming the clean-up efforts were minimal. Under Alternatives I and J, monitoring would be accompanied by additional documentation and evaluation of this site in anticipation of recreation-related projects proposed in this vicinity. Estimated cost is $5,000 under Alternatives I and J.

Cambium peeled trees were damaged and destroyed by the fire, but the extent of this loss is presently unknown. A data recovery plan has been proposed for all action alternatives to collect data from this resource which is in jeopardy of being lost. Estimated cost is $10,000 under Alternatives G and H. This cost includes locating the trees, determining their post-fire condition, designing a mitigation plan, and carrying out data recovery on a select number of trees in order to maximize knowledge about this type of cultural resource. For Alternatives I and J, the above activities are proposed, as well as interpretation of the cambium peeled trees for the public. The cost estimate under Alternatives I and J is $15,000.

One site has been identified along a section of road proposed for reconstruction under Alternatives G, H, and J. Because of the terrain, avoidance of this site is not practical. The cost of site testing and evaluation to determine the condition and extent of this site is estimated at $4,000. Until the testing has been completed, neither the need for and the type of, nor the cost of mitigation measures can be calculated. Therefore, mitigation costs are not included in this estimate. There would be no cost for this project under Alternative I because there would be no road reconstruction, and therefore no potential for impact.

APPENDIX I

CULTURAL RESOURCE

CULTURAL RESOURCES

(Laws, Agreements, SIPS, and SHPO)

TEPEE BUTTE FIRE RECOVERY AREA

By

Jeffery B. Walker, Archaeologist

The Tepee Butte inventory of prehistoric and historic sites, conducted by a crew of cultural resource technicians under the supervision of the Hells Canyon NRA archaeologist, follows the Stratified Inventory Probability System (SIPS) which is the archaeological survey design used since 1983 throughout the Wallowa-Whitman National Forest. This stratified survey design has been very successful in locating cultural resource sites on timber sales and other large projects. SIPS stratifies areas into different levels based on their potential for containing cultural resources. Survey intensities of these areas depend upon their potential. Areas with high and medium-high potential receive 100% survey coverage while areas with medium-low and low potential are given between 5% and 15% coverage. SIPS requires a minimum of 20% of the total project acreage be surveyed, but this percentage is exceeded when there is more than 15% high and medium-high potential area within any given project.

The Tepee Butte crew inventoried 21% of the gross project area. This inventory did not include the Snake River Corridor which was surveyed at a much higher intensity in 1978. Because the cultural resources within the corridor will not be affected by any proposed alternative, they are not addressed in detail in the present report.

From the data collected by the crew, a report was prepared and submitted to the Oregon State Historic Preservation Office (SHPO) for review. This report documents the Federal action taken by the Forest. The attached letter from SHPO demonstrates adequate cultural resource inventory was conducted.

All cultural resource activities comply with the following laws and agreements which stipulate the management of cultural resources on Federal Lands:

- Antiquities Act of 1906 (34 Stat. 225);
- Historic Sites Act of 1935 (49 Stat. 6660);
- Reservoir Salvage Act of 1960 (74 Stat. 220);
- National Historic Preservation Act of 1966; as amended (80 Stat. 915);
- Executive Order 11593, Preservation and Enhancement of Cultural Environment, May 13, 1971 (36 CFR 8921)
- National Environmental Policy Act of 1969, (PL 91-190);
- Archaeological and Historical Conservation Act of 1974 (88 Stat. 174);
- Archaeological Resource Protection Act of 1979 (93 Stat. 721);
- National Forest Management Act of 1976 (P.L. 94-588);
- Memorandum of Agreement Between the State Historic Preservation Office, State Parks Branch, Department of Transportation, State of Oregon, and the USDA Forest Service (Pacific Northwest Region), January 29, 1979, and Amendment #1, March 26, 1982;

- Programmatic Memorandum of Agreement for Lithic Dominated Archaeological Sites, January 11, 1984, between the Advisory Council on Historic Preservation, the Oregon State Historic Preservation Office, and the USDA Forest Service (Pacific Northwest Region);
- Programmatic Memorandum of Agreement for Historic Water Transportation Ditches, Wallowa-Whitman National Forest, between the Advisory Council on Historic Preservation, the Oregon State Historic Preservation Office, and the USDA Forest Service (Pacific Northwest Region);
- Programmatic Memorandum of Agreement Between the USDA Forest Service, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers Regarding Implementation of the Small Tracts Act (P.L. 97-465, 96 Stat. 2535).

Information on the location of sites is sensitive and therefore exempt from the Freedom of Information Act; this helps protect these resources from vandalism and site theft.

MAR 2[illegible] 1989

NEIL GOLDSCHMIDT
GOVERNOR

Department of Transportation
STATE HISTORIC PRESERVATION OFFICE
Parks and Recreation Division
525 TRADE STREET SE, SALEM, OREGON 97310

March 16, 1989

Edward C. Cole
Hells Canyon National Recreation Area
P.O. Box 490
Enterprise, OR 97828

RE: Tepee Butte Fire Recovery Project
Cultural Resource Report
Wallowa County

Dear Mr. Cole:

Our office has reviewed the cultural resource survey report for the above referenced project. The cultural resource inventory appears to be adequate given the ecological situation of steep terrains. The rugged nature of the terrain appears to explain the relatively low numbers of recorded sites. The village sites are impressive and special steps should be taken to protect them from further looting.

If you have any questions, you can contact Dr. Leland Gilsen at 378-5023.

Sincerely,

D. W. Powers III
Deputy SHPO

DWP:lr
COLE.LTR

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A		
Ass		
Public Affairs		
[illegible]		
Archaeologist	✓	
Zone Range Mgr		
Range Tech Spec		
Silviculturist		
Frstry Tech - Silv		
TPO		
Supr. Rec. Tech.		
Forestry Tech - Rec		
Civil Engrg Tech		
Forestry Tech - Trails		
Support Serv Supv		
Receptionist		
Computer [illegible]		
Resource Clk		
Payroll Clk. [illegible]		

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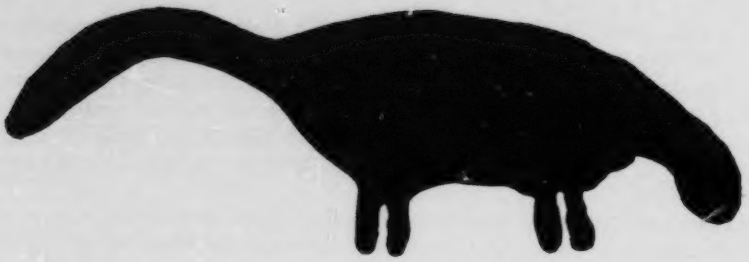


APPENDIX J

VEGETATIVE SITE PRODUCTIVITY

VEGETATION MANAGEMENT

TEPEE BUTTE FIRE RECOVERY PROJECT
By
Steven L. Fletcher, Silviculturist

SITE QUALITY

Site quality is an expression of the relative productive capacity of a site. The various environmental factors that influence the growth of the timber stand determine the favorableness of the site for forest growth. Two important factors are soil type and available moisture. Site quality is based on total tree height at a given age (generally 100 years) by species. Site quality is normally divided into classes, ranging from highest (Site Class I) to lowest (Site Class VI). Most land in the Tepee Butte Fire Area is Site Class V.

Within each site class, the specific tree height (indexed to the base age) is referred to as the site index. Within the project area, the site index ranges from a low of 66 for Douglas-fir on dry south slopes (Site Class VI) to a high of 115 for grand fir on moist north slopes (Site Class III).

Indications of productivity are basal area (total-growth) and total cubic volume (growth/acre/year). Total basal area per acre ranges from a low of 78 square feet per acre in ponderosa pine/Idaho fescue plant association to a high of 310 square feet per acre in the grand fir/Rocky Mountain maple associations. Growth basal area (base 10/20th) ranges from 85 in ponderosa pine, up to 375 in grand fir.

Cubic foot productivity in terms of cubic feet per acre per year ranges from 20 to 75. Productivity Class V (50-80 cubic feet/acre/year) is the most common with minor amounts of Class II, III, IV and VI.

Timber volume ranges from about 6 MBF/acre in areas of small-log-sized Douglas-fir and alpine fir to about 50 MBF/acre (gross volume) in some unlogged sawlog-sized grand fir/twinflower associations. Due to high cull defect in these grand fir stands (about 40%), net volumes peak at about 30 MBF/ac.

PLANT COMMUNITIES WITHIN TEPEE BUTTE PROJECT AREA

A plant association is a grouping of plants containing a definite plant species composition, with similar gross appearance or physiognomy, growing in uniform habitat conditions. These groupings are identified by using dominant vegetation and considering the environmental conditions which influence the vegetation to grow in a similar, predictable, and repetitive fashion. Plant communities within the project area are:

CLS5	15	Lodgepole pine/big huckleberry
CLF2	11	Lodgepole pine/twinflower
CEF2	21	Subalpine fir/twinflower
CWS2	11	Grand fir/big huckleberry
CWF3	11	Grand fir/twinflower
CWF4	21	Grand fir/queen's cup
CWF4	22	Pacific yew/queen's cup
CWG1	12	CWS9-12 Grand fir/Rocky Mountain maple
CWS3	21	Grand fir/spiraea
CWS4	12	Grand fir/Rocky Mountain maple-ninebark
CDG1	21	Douglas-fir/pinegrass
CDS6	22	Douglas-fir/common snowberry
CDS7	11	Douglas-fir/ninebark
CDS7	22	Douglas-fir/Rocky Mountain maple-ninebark
CDS6	34	Douglas-fir/spiraea
GB59	11	Idaho fescue/prairie junegrass (ridgetops)
GB59	16	Idaho fescue-bluebunch wheatgrass/silky lupine
SD91	11	Stiff sagebrush/Sandberg's bluegrass

These plant associations are defined in "Plant Associations of the Wallowa-Snake Province" R6-ECOL-TP-255A-86, by Charles G. Johnson, Jr., and Steven A Simon. This book is a formal publication designed to provide professional land managers with a high level of technical information about vegetation through descriptive prose, tables, and summary graphics. It contains information about the various multiple resources constituting the ecosystems of the Wallowa-Whitman National Forest.

ENVIRONMENTAL EFFECTS OF THE FIRE (from above cited publication)

Lodgepole pine/big huckleberry plant community type (PICO/ABLA2/VAME) (CLS5 15):

> Lodgepole pine produces non-serotinous and serotinous cones in the Blue and Wallowa Mountains. Fire is not necessary to open the serotinous cones as heat from increased solar radiation may be sufficient. The best germination of the species is on mineral soil or disturbed duff. Low-intensity fires tend to burn along the ground surface and result in an uneven-aged stand. High-intensity crowning fires will destroy the stand and result in a dense even-aged stand from the heavy seeding by serotinous cones. Regeneration is abundant, often resulting in stagnation at extremely early ages. The tendency of lodgepole pine to overstock and stagnate is probably the most extreme of any tree species in North American.

Lodgepole pine/twinflower plant community type (PICO/ABGR/LIBO2) (CLF2 11):

> (Same as above for CLS5 15)

Subalpine fir/twinflower plant association (ABLA2/LIBO2) (CEF2 21):

> Subalpine fir and Engelmann spruce are both highly susceptible to fire. Location of ABLA2/LIBO2 communities adjacent to streambottoms, where moisture and humidity levels are high, help prevent frequent fire occurrence. Lodgepole pine, western larch, and Douglas-fir are all fire seral members of the type gaining prominence when fire destroys the true fir and spruce.

Grand fir/big huckleberry plant association (ABGR/VAME) (CWS2 11):

Fire has been a frequent modifier of this type. Lodgepole pine replaces the fire-susceptible grand fir on gentle slopes where duff is burned deeply and intensely. On the steeper slopes, old-growth grand fir can persist with its thick bark, but more susceptible thinner-barked younger trees are often consumed. Replacement is often by western larch, Douglas-fir and even ponderosa pine as scattered seral groups within the grand fir community rather than as total stand replacement members. Larch may form large homogeneous stands on intensively burned slopes.

Grand fir/twinflower plant association (ABGR/LIBO2) (CWF3 11):

Grand fir is susceptible to fire and will succumb following ground fires if duff burns deep, damaging the roots or if the cambium is killed. Heart rot can be introduced through fire scars. Stand replacement fires result in lodgepole pine stands. Western larch and Douglas-fir are also members of fire seral communities. Larch can form pure stands following fire or persist as a fire-resistant species in later successional stages of ABGR/LIBO2. The larch-dominated stands tend to be on slopes while gentle topography usually supports lodgepole pine-dominated stands.

Grand fir/queen's cup plant association (ABGR/CLUN) (CWF4 21):

Severe disturbance by fire may result in dense homogeneous stands of lodgepole pine, Douglas-fir, and larch. More frequently, Douglas-fir and western larch invade disturbed sites as small fire seral communities within a relic grand fir stand. Stand replacement fires are uncommon in the ABGR/CLUN type. Spruce and Douglas-fir often form a fire sere prior to grand fir dominance. Big huckleberry, spiraea, pinegrass, elk sedge, and strawberries will all increase on these sites following fire. These rhizomatous plants may compete with regenerating trees though not detrimentally in this type.

Grand fir/Pacific yew/queen's cup plant association (ABGR/TABR/CLUN) (CWF4 22):

These sites are probably relic from past fires owing to their moist micro-environment. When fire enters these stands, yew is almost always eliminated. Grand fir is damaged by ground fire when duff is burned deep enough to injure the root system. Prescribed fire should be avoided in this type. Even though a light underburn may not be injurious to the duff layer, the risk is great that yew will be adversely affected.

Grand fir/pinegrass plant community type (ABGR/CARU) (CWG1 12):

Fire has been a repetitive occurrence in these communities. Disturbance creates increases by heartleaf arnica, strawberries, sticky starwort, bigleaf sandwort, and elk sedge. Promotion of pine results from periodic burning. Removal of fire in these stands may create a fire hazard by permitting sapling and pole-sized trees to form thickets and a more continuous tree understory enabling ground fire to more readily reach crowns of larger sized commercial trees.

Grand fir/Rocky Mountain maple plant association (ABGR/ACGL) (CWS9 12):

(Same as for CWF3 11)

Grand fir/spiraea plant community type (ABGR/SPBE) (CWS3 21):

Repetitive underburning will promote fire resistant ponderosa pine with a low shrub-pinegrass understory and discriminate against grand fir and Douglas-fir regeneration. Removal of fire in stands of this type will create a fire hazard from ladder fuels created by sapling and pole-sized fire thickets and undergrowth.

Grand fir/Rocky Mountain maple/ninebark plant community type (ABGR/ACGL/PHMA) (CWS4 12):

These stands are mostly on steeper slopes and have been frequented by fire in the past. With the curtailing of fire from the ecosystem, grand fir is succeeding on more favorable aspects in moister, deeper soils. Fire would probably eliminate grand fir from many sites, resulting in a shrubfield dominated by ninebark, ceanothus, spiraea, and pinegrass.

Douglas-fir/pinegrass plant association (PSME/CARU) (CDG1 21):

Elk sedge and pinegrass are both resistant to fire. Periodic ground fires of a light to moderate intensity will generally not consume old-growth trees and will leave an open understory dominated by pinegrass and elk sedge. Periodic fire may retard Douglas-fir seedling and shrubs (snowberry, spiraea) promoting the old-growth character of pine-dominated stands. An intense fire would expose areas of bare mineral soil where dormant ceanothus seed may initiate growth and establish dominance. Doghair ponderosa pine clumps also occur on areas of intense burning. Both pinegrass and elk sedge palatability should be temporarily improved by fire. Ponderosa pine needs periodic ground fire to successfully regenerate in this type whereas Douglas-fir is favored by lack of fire. Fire exclusion is rapidly converting ponderosa pine-dominated pinegrass communities to Douglas-fir with dense pole and intermediate-sized trees now often occurring beneath old-growth pines. These overstocked layered stands have a greater potential for catastrophic stand replacement fires.

Douglas-fir/common snowberry plant association (PSME/SYAL) (CDS6 22):

Frequent burns tend to promote pine and pinegrass. With reduction of fire frequency and intensity, Douglas-fir and snowberry are favored. As Douglas-fir succeeds following a fire-free period, the potential for destructive crown fire increases due to the stand structure of fire-susceptible Douglas-fir saplings and poles providing fire access to old-growth crowns. Many of the Wallowa-Snake PSME/SYAL communities are overstocked and pose a fire-damage potential to old-growth stands.

Douglas-fir/ninebark plant association (PSME/PHMA) (CDS7 11):

Fire periodicity has been high in PSME/PHMA stringers as demonstrated by the large number of even-aged stands. Fires tend to re-cycle stands every 40 years. Intense burns promote redstem ceanothus, Scouler willow, and pinegrass. Light or infrequent burning will permit a varied shrub community to persist dominated by ninebark, snowberry, and spiraea. Most of the associated shrubs resist fire and resprout basally from lower stem buds. Lightning-ignited late summer fires provide the greatest probability of stand replacement. Old-growth stands are more susceptible to crowning fires than are even-aged second growth where ladder fuels tend to be unavailable.

Douglas-fir/Rocky Mountain maple/ninebark plant association (PSME/ACGL/PHMA) (CDS7 22):

Repetitive fires have resulted in scattered old-growth ponderosa pine and Douglas-fir with high abundance of shrubs. Ninebark, maple, spiraea, snowberry, and serviceberry are all resistant to fire and resprout from stem bases following fire. The open nature of the tree overstory tends to inhibit vegetation. Ninebark appears to have a competitive advantage over the other shrub members. Maple tends to become more dominate at later stages of fire succession.

Douglas-fir/spiraea plant association (PSME/SPBE) (CDS6 34):

Repetitive burning tends to promote more fire-resistant ponderosa pine and pinegrass. Reduction of fire frequency will stimulate common snowberry and spiraea. Douglas-fir will be promoted by fire-free periods. Many stands in this type now contain heavy ladder fuels provided by Douglas-fir saplings and poles. Fire damage potential to old-growth stands is increased by removal of fire from these communities.

Idaho fescue - prairie junegrass (ridgetops) plant association (FEID-KOCR) (GB59 11):

Hot burns in the dry summer or fall period will damage Idaho fescue and bluebunch wheatgrass. Kentucky blue grass may invade or increase following hot fires due to its rhizomatous nature. Junegrass is one of the most fire-resistant perennial bunchgrasses and tends to increase on areas following burning. Fires occurring in the dormant season are less damaging to root crowns.

Idaho fescue - bluebunch wheatgrass/silky lupine plant association (FEID-AGSP/LUSE) (GB59 16)

Past fires may have promoted yarrow and arrowleaf balsamroot as these common FEID-AGSP plant associates are usually undamaged by fire. Lupines, prickly lettuce, and harsh paintbrush are also not adversely affected. Fescue may be severely damaged by hot summer or autumn fires. Spring or fall burning, where adequate soil moisture protects root crowns, is recommended in order to safeguard the Idaho fescue component of this type. Basically, fire may be detrimental to the FEID-AGSP type unless the objective is to promote diversity by increasing perennial forbs and annual vegetation.

Stiff sagebrush/Sandberg's bluegrass plant association (ARRI/POSA3) (SD91 11):

Generally the intershrub distances coupled with discontinuous grass cover make fire spread difficult in this type. Stiff sagebrush is susceptible to fire during mid summer to late fall. Sandberg's bluegrass and onespike oatgrass both are resistant to fire and may in fact respond favorably. Fire burning in areas that have been previously frost-heaved my inflict higher damage to Sandberg's bluegrass and onespike grasses because of root crown exposure to the heat.

TREATMENT HISTORY

The Dispersed Recreation/Timber Management allocation had a salvage-sanitation treatment in 1986 to remove windstorm-damaged timber in the fire area. Most of that allocation had been lightly salvage logged in past years as well. The bulk of this older activity occurred prior to the early 1970's. Logging was primarily by tractor to the old Road 46 before it was recently reconstructed, and to several low-standard wheel tracks that stub off the Road 46 a short distance. Also, salvage logging has taken place along roaded ridges like Cemetery Ridge, Deadhorse Ridge, Cold Spring Ridge, and the road to Tepee Butte. There has also been some old logging in Cherry Creek that was done in conjunction with the construction of the current road that accesses the Cherry Creek Ranch Site.

More recent projects that had some portion of their project area in common with the Tepee Butte Fire Recovery Area are:

PROJECT NAME	*PERIOD*	*VICINITY ON HCNRA DISTRICT*
North End Salvage	1986-1987	Most all DR/TM along Rd 46
Dry Fork Salvage	1981-1982	Buckhorn Springs Rd 46
Blanc Timber Sale	1980-1981	Near Rd 46 & Rd 4680 junct.
Fuzzy Timber Sale	1973-1979	Between Cottonwood Cr & Rd 4680
Lost Glove TS	1972	Between Cook Cr & Rd 46
Blowdown TS	1968-1969	Between Cook Cr & Rd 46

EMERGENCY WATERSHED REHABILITATION

Emergency watershed rehabilitation prescriptions developed immediately following the fire were implemented during the week of October 9, 1988. Treatments consisted of site specific grass seed mixes designed to reduce post-fire soil erosion, protect water quality and fisheries values, and prevent outbreaks of noxious weeds. Areas treated included moderate- to high-intensity burned areas on moderately steep to very steep slopes.

Two seed mixes were applied within the project area. Areas within the Dispersed Recreation/Timber Management and Forage Allocations were treated with a mix consisting of annual or short-lived species designed to reduce long-term competition with natural or planted conifer seedlings. The mix applied to the Dispersed Recreation/Native Vegetation Allocation was formulated with a high percentage of annual, short-lived, or native species in order to meet long-term management goals.

ACRES AND VOLUME BY LAND OWNERSHIP

The following table shows volume and acres by land ownership affected by the Tepee Butte Fire as referenced in Vegetative Management, Post Fire Condition section, Chapter III.

ACRES AND VOLUME BY LAND OWNERSHIP

A. Acres of Private Land Inside Fire Perimeter

	Burned Acres			Non-Burned Acres			
Burn Intensity	Non-timber	Timber	Subtotal	Non-Timber	Timber	Subtotal	Total
No Burn				1,212	21	1,233	1,233
Low	2,370	191	2,561				2,561
Medium	1,090	443	1,533				1,533
High	20	96	116				116
TOTAL	3,480	730	4,210	1,212	21	1,233	5,443

Volume of dead and severely damaged timber on private land:

Gross volume per acre 10.25 MBF/acre
Net volume per acre 6.49 MBF/acre

	Board Foot Gross Volume	Board Foot Deduction Unmerchantable Volume	Board Foot Net Volume
Severely Fire Damaged Trees (expected to die)	501,102	0	501,102
Salvable Dead Over 12" dbh (top log deducted)	4,562,099	- 329,032	4,233,067
Non-salvable Older Dead (dead before fire)	31,044	- 31,044	0
Non-salvable Recent Dead less than 12" dbh	2,388,957	-2,388,957	0
Total	7,483,202	-2,749,033	4,734,169

B. Acres of BLM Land Inside Fire Perimeter

	Burned Acres			Non-Burned Acres			
Burn Intensity	Non-timber	Timber	Subtotal	Non-Timber	Timber	Subtotal	Total
No Burn							
Low	27	2	29				29
Medium	37	25	62				62
High							0
TOTAL	64	27	91				91

Volume of dead and severely damaged timber on BLM land:

Gross volume per acre 12.41 MBF/acre
Net volume per acre 8.06 MBF/acre

	Board Foot Gross Volume	Board Foot Deduction Unmerchantable Volume	Board Foot Net Volume
Severely Fire Damaged Trees (expected to die)	43,311	0	43,311
Salvable Dead Over 12" dbh (top log deducted)	187,881	13,551	174,330
Non-salvable Older Dead (dead before fire)	0	0	0
Non-salvable Recent Dead less than 12" dbh	103,868	103,868	0
Total	335,060	117,419	217,641

C. Acres of National Forest Land Inside Fire Perimeter

1. Wallowa Valley District

	Burned Acres			Non-Burned Acres			
Burn Intensity	Non-timber	Timber	Subtotal	Non-Timber	Timber	Subtotal	Total
No Burn							
Low		56	56				56
Medium							
High		48	48				48
TOTAL		104	104				104

Volume of dead and severely damaged timber on BLM land:

Gross volume per acre 3.91 MBF/acre
Net volume per acre 2.97 MBF/acre

	Board Foot Gross Volume	Board Foot Deduction Unmerchantable Volume	Board Foot Net Volume
Severely Fire Damaged Trees (expected to die)	275,690	0	275,680
Salvable Dead Over 12" dbh (top log deducted)	34,965	2,204	32,761
Non-salvable Older Dead (dead before fire)	52,137	52,137	0
Non-salvable Recent Dead less than 12" dbh	43,554	43,554	0
Total	406,336	97,895	308,441

2. Hells Canyon NRA

	Burned Acres			Non-Burned Acres			
Burn Intensity	Non-timber	Timber	Subtotal	Non-Timber	Timber	Subtotal	Total
No Burn				16,380	1,581	17,961	17,961
Low	13,165	4,909	18,074				18,074
Medium	1,421	7,080	8,501				8,501
High	1,435	8,131	9,566				9,566
SUBTOTAL	16,021	20,120	36,141	16,380	1,581	17,961	54,102
TOTAL NF LAND	16,021	20,224	36,245	16,380	1,581	17,961	54,206

Volume of dead and severely damaged timber on the HCNRA:

Gross volume per acre 12.13 MBF/acre
Net volume per acre 8.48 MBF/acre

	Board Foot Gross Volume	Board Foot Deduction Unmerchantable Volume	Board Foot Net Volume
Severely Fire Damaged Trees (expected to die)	28,755,989	0	28,755,989
Salvable Dead Over 12" dbh (top log deducted)	152,535,037	-10,582,887	141,952,150
Non-salvable Older Dead (dead before fire)	16,565,251	-16,565,251	0
Non-salvable Recent Dead less than 12" dbh	46,289,763	-46,289,763	0
Total	244,146,040	-73,437,901	170,708,139

D. Summary of all Lands Inside Fire Perimeter

	Burned Acres - 68%			Non-Burned Acres - 32%			100%
Burn Intensity	Non-timber	Timber	Subtotal	Non-Timber	Timber	Subtotal	Total
No Burn				17,592	1,602	19,194	19,194
Low	15,562	5,158	20,720				20,720
Medium	2,548	7,548	10,096				10,096
High	1,455	8,275	9,730				9,730
TOTAL	19,565	20,981	40,546	17,592	1,602	19,194	59,740

Volume Volume of dead and severely damaged timber on all land ownerships:

Gross volume per acre	12.03 MBF/acre
Net volume per acre	8.39 MBF/acre

	Board Foot Gross Volume	Board Foot Deduction Unmerchantable Volume	Board Foot Net Volume
Severely Fire Damaged Trees (expected to die)	29,576,082	0	29,576,082
Salvable Dead Over 12" dbh (top log deducted)	157,319,982	-10,927,674	146,392,308
Non-salvable Older Dead (dead before fire)	16,648,432	-16,648,432	0
Non-salvable Recent Dead less than 12" dbh	48,826,142	-48,826,142	0
Total	252,370,638	-76,402,248	175,968,390

E. Breakdown of HCNRA Acres by CMP Allocation and Burn Intensity

	Scenic River		DR / NV		Forage		DR / TM		TOTAL	
Burn Intensity	Non-timber	Timber	Non-Timber	Timber	Non-timber	Timber	Non-Timber	Timber	Non-Timber	Timber
No Burn	308		11,981	879	2,043	249	2,048	453	16,380	1,581
Low	286		10,665	2,198	1,507	610	707	2,101	13,165	4,909
Medium	21		950	3,503	212	1,195	238	2,382	1,421	7,080
High			820	3,140	441	2,836	174	2,155	1,435	8,131
TOTAL	615		24,416	9,720	4,203	4,890	3,167	7,091	32,401	21,701
Net* Volume fire-killed and severely damaged			70,767 MBF		47,442 MBF		52,500 MBF		170,709 MBF	
Average net* volume/acre (based on burned timbered ac.)			8.00 MBF/acre		10.22 MBF/acre		7.91 MBF/acre		8.48 MBF/acre	
Species composition of fire-killed and severely damaged										
D. fir and W. larch			54% 37,889 MBF		53% 25,129 MBF		36% 19,139 MBF		48% 82,157 MBF	
G. fir and Others			31% 22,328 MBF		35% 16,538 MBF		52% 27,218 MBF		39% 66,084 MBF	
Ponderosa pine			15% 10,550 MBF		12% 5,775 MBF		12% 6,143 MBF		13% 22,468 MBF	
Totals			100% 70,767 MBF		100% 47,442 MBF		100% 52,500 MBF		100% 170,709 MBF	

* Net volume is based on trees over 9" dhb in the severely fire-damaged category and only those trees over 12" dbh in the fire-killed category. Deterioration of trees between 9" and 12" inch dbh in the fire-killed category is assumed due to checking and cracking during the one year delay between the burn and probable salvage. Also, the top 16' cruise log from all fire-killed trees under 25" dbh has been deducted due to checking, cracks, and breakage during felling.

APPENDIX K

ROAD MANAGEMENT PLAN

ROAD MANAGEMENT PLAN

TEPEE BUTTE FIRE RECOVERY AREA
BY
MARTY J. GARDNER
Transportation/Logging Systems Planner

I. INTRODUCTION

This Road Management Plan is part of the Tepee Butte Recovery Project environmental analysis. Its purpose is to identify a range of road management options to be incorporated into the different alternatives identified by the ID Team.

The reason for a range of options is to deal with different issues identified dealing with road management. These are identified below:

1. Need to close roads to reduce the amount of harassment to wildlife, mainly elk. This is to mitigate the loss of hiding cover.
2. Need to have roads open to the public, other than Roads 46 and 4680, to allow dispersed recreation.
3. Need to analyze the impacts of the alternatives as they relate to road maintenance costs.
4. Need to display a transportation plan for the ID Team to analyze the plan's relationship to the guidelines given in the CMP.
5. Need to reduce road densities, especially in areas where roads are not compatible with resource values.

This plan addresses existing and proposed roads for each range of options and identifies their purpose, use, maintenance level, closure type, surfacing, and provides a complete list identifying the range of options. A completed Road Management Objective Form is included as an example of selected options for a road.

Three different road closure options were developed. They are High, Medium, and Low as defined below:

High	This option assumes a high number of road closures with the intent of minimizing harassment to wildlife as a result of lost habitat. This was used with Alternatives G and H
Medium	This option is a blend of High and Low and is a compromise of resource values. This was used with Alternative J.
Low	This option assumes a low amount of road closures with the intent of leaving roads open to increase the amount of dispersed recreation opportunity. This was used with Alternative I.

All options are within the framework of the CMP and assume that low amounts of road density are in the best interest of visual quality objectives, recreation values, and wildlife habitat needs.

II. ROAD MANAGEMENT OBJECTIVES

The following is a list of the Road Management Objectives (RMO) identified for the area and used in the different road management plan options.

A. **Closed to All Use**: These roads are for timber harvest only and are not for public or administrative uses. The road entrances are to appear natural (rough and obscured) to give the impression the road does not exist from either Road 4600 or Road 4680.

B. **Accept Unrestricted Public Use:** These roads are open for public, administrative, and commercial use. They are maintained for high-clearance vehicles and are closed only during the big game hunting season (green dot closure).

C. **Encourage Public Use:** These roads are open for public, administrative, and commercial use. They are maintained for low-clearance vehicles and are open during the big game season.

D. **Road 4600780:** This RMO is developed for Road 4600780. It indicates the present and future levels of use. Under this RMO the road would be upgraded to accommodate the trailhead it accesses. This would be an open road for low-clearance vehicles.

E. **Encourage Public Use:** These roads are similar to RMO "B;" however, the difference is that these roads "encourage" unrestricted public use whereas RMO "B" is at an "accept" level of use.

F. **Open for administrative use**: These roads are not open to the public and are for commercial and administrative uses only. They are maintained for high-clearance vehicles and have a blocking device that can be opened at the entrance or a short distance from the entrance. Any public use is discouraged and they are closed to all use during the big game season (green dot closure).

G. **Open for Administrative Use:** These roads are the same as "F" above except they may have more administrative use than "F" and have a gate at the entrance rather than a blocking device. These are also closed during the big game season (green dot closure)

H. **Open for Administrative Use:** These roads are the same as "F" above except they already have a blocking device or a gate which closes them. Another blocking device or gate is not needed.

I. **Road 4600788:** This RMO is specific to Road 4600788 beyond the gate at the trailhead. The last mile of the 4600788 road is closed to all use except for permittee at Cherry Ranch and administrative use.

J. **Delete:** This means the road is to be removed from the road system. It is not needed for timber harvest or it does not meet the intent of the allocation strategy it is in. These roads will either be converted to trails, obliterated mechanically, or barricaded and left to close themselves naturally.

All blocking devices are considered part of a road maintenance barricade but can be opened by one or two people. They are to be out of sight from Roads 4600 and 4680 for visual quality reasons. The devices are to be in places where they are effective or extensions could be added to keep vehicles from going around them. The short segment of road between the barricade and Roads 4600 and 4680 is for dispersed recreation.

All gates are to be rustic in nature but easily opened. These can be within view from either the 4600 and 4680 roads. They may also need some added side support to ensure that vehicles do not go around.

All rough and obscure roads are to have that portion of the road visible from Roads 4600 and 4680 brought to a naturally-appearing condition by a variety of methods. Waterbars, dirt berms, and ripping the length of the road are not acceptable. To ensure adequate closure, a dirt berm or barricade may be placed out of sight from Roads 4600 and 4680.

III. MAINTENANCE LEVELS

A. Maintenance Level 1

This level is basic custodial care as required to protect the road investment and to see that damage to adjacent land and resources is held to a minimum. Level 1 maintenance often requires an annual inspection to determine what work, if any, is needed to keep drainage functional and the road stable. This level is the normal prescription for roads that are not opened for traffic. Level 1 is to maintain drainage facilities and runoff patterns.

Physical closure devices and appropriate signing are in place and functional in accordance with FSH 7770.

B. Maintenance Level 2

This level is used on roads where management requires that the road be open for limited passage of traffic. Traffic is normally minor, usually consisting of one or a combination of the following: Administrative use, permitted use, or specialized traffic.

All route markers, regulatory, and warning signs in place and usable.

C. Maintenance Level 3

This level is used on roads which are opened for public traffic and generally applies when use does not exceed 15 AOT. AOT should be used as a guide in determining the Maintenance Level and not as a sole criteria. A road may receive only one or two vehicles a day for most of the year; however, during a brief period; i.e. hunting season, the road may receive 20 or 30 vehicles a day. Total traffic types and planned use are important criteria for selecting Maintenance Level. The road is maintained for safe and moderately convenient travel suitable for passenger cars.

Signing. Route markers, warning, directional, informational, regulatory signs, and traffic control devices are in place, neat in appearance, and functional.

IV. ALTERNATIVE SUMMARY AND ROAD MANAGEMENT OBJECTIVE FORMS

The following is a list of the roads and road management plans by alternative:

LEGEND:

RMO

A-J
(See Text)
* - Current RMO, no change

CLOSURE TYPE

B - Barricade
OB - Obscure Entrance
PG - Previous Gate
PB - Previous Barricade
DEL- Delete from road system

OTHER

MP - Milepost
N/A- Not Applicable

ML

Maintenance Level

1 - Not open for traffic
2 - Limited traffic, mainly administrative and permitted uses
3 - Suitable for passenger cars; open to public traffic

ROAD MANAGEMENT PLAN
ALTERNATIVE A

See Legend on Page 4

Road Number	RMO	Open-Closed	Closure Type	Miles	ML	From	To
4600788	*	0	-	7.7	2	4600780	END
4680	*	0	-	6.2	3	4600	MP 6.2
4680	*	0	-	3.2	2	MP 6.2	4680250
8000A.A	*	C	B	1.7	2	4680035	END
8000B.A	*	C	B	0.3	2	8000A.A	END
4680035	*	C	B	1.3	2	4680	4680
4680037	*	0	-	0.4	2	4680	4600670
4680040	*	0	-	3.7	2	4680	END
4680050	*	0	-	1.2	2	4680040	END
4680051	*	C	B	0.5	1	4680050	END
4680075	*	0	-	1.9	2	4680050	END
4680080	*	0	-	0.8	2	4680075	4680050
4680090	*	0	-	0.6	2	4680	4680075
4680100	*	0	-	0.7	2	4680090	END
4680110	*	0	-	0.1	2	4680	END
4680115	*	0	-	0.2	2	4680	4680
4680120	*	0	-	0.3	2	4680	END
4680128	*	0	-	0.2	2	4680120	END
4680126	*	0	-	0.3	2	4680123	END
4680130	*	0	-	0.4	2	4680	4680
4680135	*	0	-	0.4	2	4680130	4680126
4680140	*	0	-	0.6	2	4680	END
4680145	*	C	B	0.1	2	4680140	END
4680150	*	C	B	0.8	2	4680	END
4680170	*	0	-	1.2	2	4680	END
4680175	*	0	-	0.4	2	4680	END
4680200	*	0	-	3.0	2	4680	END
4680215	*	0	-	0.3	2	4680	END
4680219	*	0	-	0.5	2	4680	END

Road Number	RMO	Open-Closed	Closure Type	Miles	ML	From	To
4680220	*	0	-	1.0	2	4680	END
4680230	*	0	-	0.4	2	4680	END
4680250	*	0	-	8.0	2	4680	END
4600673	N/A	-	-	-	-	-	-
4600673	*	0	-	1.0	2	4600670	END
4600674	N/A	-	-	-	-	-	-
4600675	*	C	B	0.4	2	4600670	4600680
4600678	*	0	-	0.8	2	4600670	END
4600680	*	C	OB	0.9	2	4600	4600675
4600697	N/A	-	-	-	-	-	-
4600697	*	0	-	0.1	2	4600	END
4600717	*	C	OB	0.3	2	4600	END
4600720	N/A	-	-	-	-	-	-
4600723	*	C	B	0.2	2	4600	END
4600726	*	C	OB	0.3	2	4600	END
4600730	*	C	B	2.16	2	4600	END
4600735	*	0	-	0.6	2	4600	END
4600739	*	C	OB	0.6	2	4600	END
4600760	*	0	-	3.9	2	4600	MP 2.9
4600761	*	C	OB	0.7	2	4600760	END
4600762	*	C	OB	1.3	2	4600760	END
4600763	*	0	-	1.1	2	4600760	END
4600770	*	C	OB	1.0	2	4600	END
4600780	*	0	-	0.8	3	4600	4600810
4600780	*	0	-	1.2	2	4600810	MP 2.0
4600780	DEL	-	-	-	-	-	-
4600783	*	0	-	0.3	3	4600780	END
4600	*	0	-	13.4	3	4600780	4600595
4600789	*	0	-	0.3	2	4600780	END
4600B.B	*	C	B	0.9	2	4600	END
4600D.A	*	C	OB	0.2	1	4600780	END
4600Y	*	0	-	1.4	2	4600	END
46002.A	*	0	-	0.4	2	4600	END
4600595	*	0	-	0.5	2	4600	4600596

Road Number	RMO	Open-Closed	Closure Type	Miles	ML	From	To
4600596	*	0	-	4.2	2	4600595	END
4600597	N/A	-	-	-	-	-	-
4600598	*	0	-	0.4	2	4600596	END
4600601	*	0	-	1.8	2	4600	4600595
4600603	*	C	B	1.3	2	4600608	4600601
4600605	DEL	-	-	0.2	-	4600603	4600595
4600608	N/A	-	-	-	-	-	-
4600608	*	0	-	1.3	2	4600596	MP .5
4600609	N/A	-	-	-	-	-	-
4600609	*	0	-	0.4	2	4600	END
4600613	*	0	-	0.3	2	4600	END
4600625	*	0	-				
4600625	*	0	-	0.3	2	4600	MP .3
4600625	*	C	B	1.1	1	MP .3	END
4600670	*	0	-	6.4	2	4600	END

ROAD MANAGEMENT PLAN
ALTERNATIVE G

See Legend on Page 4

Road Number	RMO	Open-Closed	Closure Type	Miles	ML	From	To
4600	CUR	O	-	13.4	3	4600780	4600595
4600789	DEL	-	-	-	-	4600780	END
4600B.B	F	C	B	0.9	2	4600	END
4600B.A	DEL	-	-	-	-	-	-
4600Y	F	C	B	1.4	1	4600	END
46002.A	A	C	OB	0.4	1	4600	END
4600595	B	O	-	0.5	2	4600	4600590
4600596	B	O	-	0.9	2	4600595	MP .9
4600596	G	C	G	3.4	2	MP .9	END
4600597	F	C	B	0.4	1	4600596	END
4600598	H	C	PG	0.4	2	4600596	END
4600601	F	C	B	0.9	1	4600	4600595
4600603	DEL	-	-	-	-	4600608	MP .9
4600603	F	C	PB	0.7	1	MP .7	4600601
4600605	DEL	-	-	-	-	4600603	4600595
4600608	DEL	-	-	-	-	4600596	MP .5
4600603	G	C	G	0.4	2	4600595	4600608 MP.5
4600608	G	C	PG	0.8	2	MP. 5	END
4600609	F	C	B	0.2	1	4600608	END
4600609	A	C	OB	0.4	1	4600	END
4600613	A	C	OB	0.3	1	4600	END
4600625	B	O	-	0.3	2	4600	MP .3
4600625	F	C	B	1.1	1	MP .3	END
4600670	G	C	G	6.7	1	4600	END
4600673	F	C	B	1.7	1	4600673	END
4600673	H	C	PG	1.0	1	4600670	4600673
4600674	H	C	PG	0.3	1	4600673	END
4600675	F	C	B	0.4	1	4600070	4600680
4600678	H	C	PG	0.8	1	4600670	END

Road Number	RMO	Open-Closed	Closure Type	Miles	ML	From	To
4600680	F	C	B	0.9	1	4600	4600675
4600697	A	C	O	0.4	1	4600	END
4600717	A	C	OB	0.3	1	4600	END
4600720	F	C	B	0.2	1	4600720	END
4600723	A	C	OB	0.2	1	4600	END
4600726	A	C	OB	0.3	1	4600	END
4600730	F	C	B	0.7	1	4600	MP .7
4600730	DEL	-	-	-	-	MP .7	END
4600735	A	C	OB	0.6	1	4600	END
4600739	A	C	OB	0.6	1	4600	END
4600760	D	O	-	2.9	2	4600	MP 2.9
4600760	DEL	-	-	-	-	MP 2.9	END
4600761	A	C	OB	0.7	1	4600760	END
4600762	A	C	OB	0.2	1	4600760	MP .2
4600762	DEL	-	-	-	-	MP .2	END
4600763	A	C	OB	1.1	1	4600760	END
4600770	A	C	OB	1.0	1	4600	END
4600780	C	O	-	0.8	3	4600	4600810
4600780	D	O	-	1.3	2	4600810	MP 2.0
4600780	DEL	-	-	-	-	MP 2.0	END
4600783	C	O	-	0.2	3	4600780	END
4600788	*	O	-	7.6	2	4600	END
4680	*	O	-	9.9	3	4600	4680250
8000A	H	C	PB	1.7	1	4680035	END
8000B	H	C	PB	0.3	1	8000A	END
4680035	F	C	B	0.9	1	4680	MP .9
4680035	DEL	C	-	-	-	MP .9	4680
4680037	F	C	B	0.4	1	4680	4600670
4680040	G	O	-	1.3	1	4680	MP 1.3
4680040	DEL	-	-	-	-	MP 1.3	END
4680050	H	C	PG	1.2	1	4680040	END
4680051	F	C	B	0.5	1	4680050	
4680075	H	C	PG	1.9	1	4680050	END

Road Number	RMO	Open-Closed	Closure Type	Miles	ML	From	To
4680080	H	C	B	0.6	1	4680075	4680050
4680090	F	C	B	0.1	1	4680080	4680100
4680090	DEL	-	-	-	-	4680100	4680075
4680100	DEL	-	-	-	-	4680090	END
4680110	B	O	-	0.1	2	4680	END
4680115	DEL	-	-	-	-	4680	4680
4680120	F	C	B	0.3	1	4680	END
4680123	H	C	PB	0.2	1	4680120	END
4680126	H	C	PB	0.3	1	4680123	END
4680130	DEL	-	-	-	-	4680	4680
4680135	H	C	PB	0.4	1	4680130	4680126
4680140	F	C	B	0.6	1	4680	END
4680145	H	C	PB	0.1	1	4680140	END
4680150	B	O	-	0.8	2	4680	END
4680170	B	O	-	0.4	2	4680	MP .4
4680170	DEL	-	-	-	-	MP .4	4680175
4680175	DEL	-	-	-	-	4680	END
4680200	G	C	G	3.0	1	4680	MP 3
4680215	DEL	-	-	-	-	4680	4680
4680219	H	C	B	0.5	1	2680	END
4680220	G	C	G	1.5	1	4680	MP 1.5
4680230	DEL	-	-	-	-	4680	4680
4680250	G	C	G	8.0	1	4680	END

ROAD MANAGEMENT PLAN
ALTERNATIVE H

See Legend on Page 4

Road Number	RMO	Open-Closed	Closure Type	Miles	ML	From	To
4600	*	O	-	13.4	3	4600780	4600595
4600789	DEL	-	-	-	-	4600780	END
4600B.B	F	C	B	.9	2	4600	END
4600D.A	DEL	-	-	-	-	4600780	END
4600Y	F	C	B	1.4	1	4600	END
4600Z.A	A	C	OB	0.4	1	4600	END
4600595	B	O	-	0.5	2	4600	4600596
4600596	G	C	G	0.9	2	4600595	MP .9
4600596	G	C	G	3.4	2	MP .9	END
4600597	F	C	B	0.4	1	4600596	END
4600598	H	C	PG	0.4	2	4600596	END
4600601	F	C	B	0.9	1	4600	4600595
4600603	DEL	-	-	-	-	4600608	MP .9
4600603	F	C	PB	0.7	1	MP .7	4600601
4600605	DEL	-	-	-	-	4600603	4600595
4600608	DEL	-	-	-	-	4600596	MP .5
4600608	G	C	G	0.4	2	4600595	4600608 MP .5
4600603	G	C	PG	0.8	2	MP .5	END
4600609	N/A	-	-	-	-	-	-
4600609	A	C	OB	0.4	1	4600	END
4600613	A	C	OB	0.3	1	4600	END
4600625	B	O	-	0.3	2	4600	MP .3
4600625	F	X	B	1.1	1	MP .3	END
4600670	G	C	G	6.7	1	4600	END
4600673	F	C	B	1.7	1	4600673	END
4600673	H	C	PG	0.1	1	4600670	4600673
4600674	H	C	PG	0.3	1	4600667	END
4600675	F	C	B	0.4	1	4600670	4600680

Road Number	RMO	Open-Closed	Closure Type	Miles	ML	From	To
4600678	H	C	PG	0.8	1	4600670	END
4600680	F	C	B	0.9	1	4600	4600675
4600697	A	C	O	0.4	1	4600	END
4600717	A	C	OB	0.3	1	4600	END
4600720	N/A	-	-	-	-	-	-
4600723	A	C	OB	0.2	1	4600	END
4600725	A	C	OB	0.3	1	4600	END
4600730	F	C	B	0.7	1	4600	MP .7
4600730	DEL	-	-	-	-	MP .7	END
4600735	A	C	OB	0.6	1	4600	END
4600739	A	C	OB	0.6	1	4600	END
4600760	D	O	-	2.9	2	4600	MP 2.9
4600760	DEL	-	-	-	-	MP 2.9	END
4600761	A	C	OB	0.7	1	4600760	END
4600762	A	C	OB	0.2	1	4600760	MP .2
4600762	-	-	-	1.1	-	MP .2	END
4600763	A	C	OB	1.1	1	4600760	END
4600770	A	C	OB	1.0	1	4600	END
4600780	C	0	-	0.8	3	4600	4600810
4600780	0	0	-	1.2	2	4600810	MP 2.0
4600780	DEL	-	-	-	-	MP 2.0	END
4600783	C	0	-	0.3	3	4600780	END
4600788	*	0	-	7.6	2	4600	END
4680	*	0	-	9.9	3	4600	4680250
8000A	H	C	PB	1.7	1	4680035	END
8000B	H	C	PB	0.3	1	8000A	END
4680035	F	C	B	0.9	1	4680	MP .9
4680035	DEL	0	0	0	0	MP .9	4680
4680037	F	C	B	0.4	1	4680	4600670
4680040	G	O	-	1.3	1	4680	MP 1.3
4680040	DEL	-	-	-	-	MP 1.3	END
4680050	H	C	PG	1.2	1	4680040	END
4680075	H	C	PG	1.9	1	4680050	END
4680051	F	C	B	0.5	1	4680050	

Road Number	RMO	Open-Closed	Closure Type	Miles	ML	From	To
4680080	H	C	B	0.8	1	4680075	4680050
4680090	F	C	B	0.2	1	4680080	4680100
4680090	DEL	-	-	-	-	4680100	4680075
4680100	DEL	-	-	-	-	4680090	END
4680110	B	0	-	0.1	2	4680	END
4680115	DEL	-	-	-	-	4680	4680
4680120	F	C	B	0.3	1	4680	END
4680123	H	C	PB	0.2	1	4680120	END
4680126	H	C	PB	0.3	1	4680123	END
4680130	DEL	-	-	-	-	4680	4680
4680135	H	C	PB	0.4	1	4680130	4680126
4680140	F	C	B	0.6	1	4680	END
4680145	H	C	PB	0.1	1	4680140	END
4680150	B	O	-	0.8	2	4680	END
4680170	B	O	-	0.4	2	4680	MP .4
4680170	DEL	-	-	-	-	MP .4	4680175
4680175	DEL	-	-	-	-	4680	END
4680200	G	C	G	3.0	1	4680	MP 3
4680215	DEL	-	-	-	-	4680	4680
4680219	H	C	B	0.5	1	4680	END
4680220	G	C	G	1.5	1	4680	MP 1.5
4680230	DEL	-	-	-	-	4680	4680
4680250	G	C	G	8.0	1	4680	END

ROAD MANAGEMENT PLAN
ALTERNATIVE I

See Legend on Page 4

Road Number	RMO	Open-Closed	Closure Type	Miles	ML	From	To
4600	*	O	-	13.4	3	4600780	4600595
4600789	DEL	-	-	-	-	4600780	END
4600B.B	F	C	B	0.9	2	4600	END
4600D.A	DEL	-	-	-	-	-	-
4600Y	F	C	B	1.4	1	4600	END
4600Z.A	A	C	OB	0.4	1	4600	END
4600595	B	O	-	0.5	2	4600	4600596
4600596	G	C	G	0.9	2	4600595	MP.9
4600596	G	C	G	3.4	2	MP .9	END
4600597	N/A	-	-	-	-	-	-
4600598	H	C	PG	0.4	2	4600596	END
4600601	B	O	-	0.5	2	4600	4600603
4600601	F	C	B	0.4	1	46603	4600595
4600603	DEL	-	-	-	-	4600608	MP .9
4600603	B	O	-	0.7	2	MP .7	4600601
4600605	DEL	-	-	-	-	4600603	4600595
4600608	DEL	-	-	-	-	4600596	MP .5
4600608	B	O	-	0.4	2	4600595	4600608 MP .5
4600608	B	O	-	0.8	2	MP .5	END
4600609	N/A	-	-	-	-	-	-
4600609	A	C	OB	0.4	1	4600	END
4600613	B	O	-	0.4	2	4600	END
4600625	B	O	-	0.3	2	4600	MP .3
4600625	F	C	B	1.1	1	MP .3	END
4600670	B	O	-	3.0	2	4600	MP 3.0
4600670	F	C	B	3.4	1	MP 3.0	END
4600673	N/A	-	-	-	-	-	-
4600673	F	C	B	0.1	1	4600670	4600673

Road Number	RMO	Open-Closed	Closure Type	Miles	ML	From	To
4600674	N/A	-	-	-	-	-	-
4600675	F	C	B	0.4	1	4600670	4600680
4600678	F	C	B	0.8	1	4600670	END
4600680	F	C	B	0.9	1	4600	4600675
4600697	A	C	O	0.4	1	4600	END
4600717	A	C	OB	0.3	1	4600	END
4600720	N/A	-	-	-	-	-	-
4600723	A	C	OB	0.2	1	4600	END
4600726	A	C	OB	0.3	1	4600	END
4600730	F	C	B	0.7	1	4600	MP .7
4600730	DEL	-	-	-	-	MP .7	END
4600735	A	C	OB	0.6	1	4600	END
4600739	A	C	OB	0.6	1	4600	END
4600760	D	O	-	2.9	2	4600	MP 2.9
4600760	DEL	-	-	-	-	MP 2.9	END
4600761	A	C	OB	0.7	1	4600760	END
4600762	A	C	OB	0.2	1	4600760	MP .2
4600762	DEL	-	-	-	-	MP .2	END
4600763	A	C	OB	1.1	1	4600760	END
4600770	A	C	OB	1.0	1	4600	END
4600780	C	O	-	0.8	3	4600	4600810
4600780	D	O	-	1.2	2	4600810	MP 2.0
4600780	DEL	-	-	-	-	MP 2.0	END
4600783	C	O	-	0.3	3	4600780	END
4600788	*	O	-	7.6	2	4600	END
4680	*	O	-	6.2	3	4600	MP 6.2
4680	*	O	-	3.7	2	MP 6.2	4680250
8000A	H	C	PB	1.7	1	4680035	END
8000B	H	C	PB	0.3	1	8000A	END
4680035	F	C	B	0.9	1	4680	MP .9

Road Number	RMO	Open-Closed	Closure Type	Miles	ML	From	To
4680035	DEL	-	-	-	-	MP .9	4680
468037	B	O	-	0.4	2	4680	4600670
4680040	B	O	-	0.1	2	4680	4680050
4680040	G	C	B	1.2	1	4680050	MP 1.3
4680040	DEL	-	-	-	-	MP 1.3	END
4680050	B	O	-	1.2	2	4680040	END
4680051	F	C	B	0.5	1	4680050	-
4680075	F	C	B	1.9	1	4680050	END
4680080	F	C	B	0.8	1	4680025	4680050
4680090	F	C	B	0.2	1	4680080	4680100
4680090	DEL	-	-	-	-	4680100	4680025
4680100	DEL	-	-	-	-	4680090	END
4680110	B	O	-	0.1	2	4680	END
46800115	B	O	-	0.2	2	4680	4680
4680120	F	C	B	0.3	1	4680	END
4680123	H	C	PB	0.2	1	4680120	END
4680126	H	C	PB	0.3	1	4680123	END
4680130	DEL	-	-	-	-	4680	4680
4680135	H	C	PB	0.4	1	4680130	4680126
4680140	B	O	-	0.6	2	4680	END
4680145	F	C	B	0.1	1	4680140	END
4680150	B	O	-	0.8	2	4680	END
4680170	B	O	-	0.4	2	4680	MP .4
4680170	DEL	-	-	-	-	MP .4	4680175
4680175	DEL	-	-	-	-	4680	END
4680200	B	O	-	3.0	2	4680	MP 3.0
4680215	DEL	-	-	-	-	4680	4680
4680219	B	O	-	0.5	2	4680	END
4680220	B	O	-	1.5	2	4680	MP 1.5
4680230	DEL	-	-	-	-	4680	4680
4680250	B	O	-	8.0	2	4680	END

ROAD MANAGEMENT PLAN
ALTERNATIVE J

See Legend on Page 4

Road Number	RMO	Open-Closed	Closure Type	Miles	ML	From	To
4600	*	O	-	13.4	3	4600780	4600595
4600789	DEL	-	-	-	-	4600780	END
4600B.B	F	C	B	0.9	2	4600	END
4600D.A	DEL	-	-	-	-	-	-
4600Y	F	C	B	1.4	1	4600	END
4600Z.A	A	C	OB	0.4	1	4600	END
4600595	B	O	-	0.5	2	4600	4600596
4600596	G	C	G	0.9	2	4600595	MP .9
4600596	G	C	G	3.4	2	MP .9	END
4600597	F	C	B	0.4	1	4600596	END
4600598	H	C	PG	0.4	2	4600596	END
4600601	B	O	-	0.9	2	4600	4600595
4600603	DEL	-	-	-	-	4600608	MP .9
4600603	F	C	B	0.7	1	MP .7	4600601
4600605	DEL	-	-	-	-	4600603	4600595
4600608	DEL	-	-	-	-	4600596	MP .5
4600608	G	C	G	0.4	2	4600595	4600608 MP .5
4600608	G	C	PG	0.8	2	MP.5	END
4600609	F	C	B	0.2	1	4600608	END
4600609	A	C	OB	0.4	1	4600	END
4600613	B	O	-	0.4	2	4600	END
4600625	B	O	-	0.3	2	4600	MP .3
4600625	F	C	B	1.1	1	MP .3	END
4600670	B	O	-	3.0	2	4600	MP 3.0
4600670	F	C	B	3.4	1	MP 3.0	END
4600673	F	C	B	1.7	1	4600673	END
4600673	F	C	B	0.1	1	4600670	4600673
4600674	H	C	PG	0.3	1	4600673	END

Number	Road RMO	Closed	Open-Type	Closure Miles	ML	From	To
4600675	F	C	B	0.4	1	4600670	4600680
4600678	F	C	B	0.8	1	4600670	END
4600680	F	C	B	0.9	1	4600	4600675
4600697	A	C	O	0.4	1	4600	END
4600717	A	C	OB	0.3	1	4600	END
4600720	F	C	B	0.2	1	4600720	END
4600723	A	C	OB	0.2	1	4600	END
4600726	A	C	OB	0.3	1	4600	END
4600730	F	C	B	0.7	1	4600	MP .7
4600730	DEL	-	-	-	-	MP .7	END
4600735	A	C	OB	0.6	1	4600	END
4600739	A	C	OB	0.6	1	4600	END
4600760	D	O	-	2.9	2	4600	MP 2.9
4600760	DEL	-	-	-	-	MP 2.9	END
4600761	A	C	OB	0.7	1	4600760	END
4600762	A	C	O	0.2	1	4600760	MP .2
4600762	DEL	-	-	-	-	MP .2	END
4600763	A	C	OB	1.1	1	4600760	END
4600770	A	C	OB	1.0	1	4600	END
4600780	C	O	-	0.8	3	4600	4600810
4600780	D	O	-	1.2	2	4600810	MP 2.0
4600780	DEL	-	-	-	-	MP 2.0	END
4600783	C	O	-	0.3	3	4600780	END
4600788	*	O	-	7.6	2	4600	END
4680	*	O	-	9.9	3	4600	4680250
8000A	H	C	PB	1.7	1	4680035	END
8000B	H	C	PB	0.3	1	8000A	END
4680035	F	C	B	0.9	1	4680	MP .9
4680035	DEL	-	-	-	-	MP .9	4680
468037	B	O	-	0.4	2	4680	4600670
4680040	B	O	-	0.1	2	4680	4680050
4680040	G	C	B	1.2	1	4680050	MP 1.3
4680040	DEL	-	-	-	-	MP 1.3	END

Road Number	RMO	Open-Closed	Closure Type	Miles	ML	From	To
4680050	B	O	-	1.2	2	4680040	END
4680051	F	C	B	0.5	1	4680050	-
4680075	F	C	B	1.9	1	4680050	END
4680080	F	C	B	0.8	1	4680075	4680050
4680090	F	C	B	0.2	1	4680080	4680100
4680090	DEL	-	-	-	-	4680100	4680075
4680100	DEL	-	-	-	-	4680090	END
4680110	B	O	-	0.1	2	4680	END
4680115	DEL	-	-	-	-	4680	4680
4680120	F	C	B	0.3	1	4680	END
4680123	H	C	PB	0.2	1	4680120	END
4680126	H	C	PB	0.3	1	4680123	END
4680130	DEL	-	-	-	-	4680	4680
4680135	H	C	PB	0.4	1	4680130	4680126
4680140	F	C	B	0.6	1	4680	END
4680145	H	C	PB	0.1	1	4680140	END
4680150	B	O	-	0.8	2	4680	END
4680170	B	O	-	0.4	2	4680	MP .4
4680170	DEL	-	-	-	-	MP .4	4680175
4680175	DEL	-	-	-	-	4680	END
4680200	G	C	G	3.0	1	4680	MP 3
4680215	DEL	-	-	-	-	4680	4680
4680219	H	C	B	0.5	1	4680	END
4680220	B	O	-	1.5	2	4680	MP 1.5
4680230	DEL	-	-	-	-	4680	4680
4680250	G	C	G	8.0	1	4680	END

Below is a sample of choices made from options listed under each heading. The reviewer may see a complete set for each RMO by consulting the analysis file.

ROAD MANAGEMENT PLANNING

- A. ROAD MANAGEMENT OBJECTIVES
  - 1. Traffic Type
    - a. Commercial
  - 2. Traffic Volume
    - a. Log Haul
  - 3. Vehicle Volume
    - a. Std, Log Truck
    - i. High Clearance Only
  - 4. Recreation or Other Public Uses
    - b. Dispersed Recreation Access
  - 5. Season of Use
    - d. Dry Season Only
    - e. Frozen Condition Only
  - 6. Safety and Convenience
    - a. Low Speed (0-15 mph)
    - e. Rough Surface (Native or Pit Run)
    - h. No Dust Abatement
  - 7. Overall Road Mgmt Strategy
    - f. Discourage All Use Until Next Project

- B. ENVIRONMENTAL OR POLITICAL CONSTRAINTS
  - 1. Environmental
    - c. Wildlife Habitat
  - 2. Political
    - c. Other (ODF&W)

- C. WARRANT ANALYSIS
  - 1. Traffic Management Warrants
    - a. Entrance Information
      - (2) Blocking Device Intersection Rough or Obscure
    - b. General Roadway Information
      - (3) Hazard Marking
    - c. Traffic Rules

- C. WARRANT ANALYSIS (continued)
  - 1. Traffic Warrants/Rules
    - (3) Seasonal Restriction
  - 2. Road Maintenance Warrants
    - a. Maintenance Level (End Result Desired)
      - (1) Level 1
    - b. User Maintenance
      - (1) User Perf. (Above Comm. Share)
  - 3. Design Warrants
    - a. Design Control Factors
      - (1) Capacity
        - (a) Single Lane
      - (2) Service Element
        - (b) Long-Term Intermittent Use
      - (3) Traveled Way Width
        - (b) 12 feet
      - (4) Average Design Speed
        - (a) Low (0-15 mph)
      - (5) Ditch, Shoulder, Dike Element
        - (h) H-No Shoulder, Ditch, or Dike
      - (6) Pavement Structure
        - (a) 0-Native Material

- D. ASSESSMENT FOR ROAD ADEQUACY
  - 1. Road has adequate capacity to safely handle existing traffic.

REMARKS: Road use prohibited during the big game hunting season (Green Dot Closure) by CFR B.1, B.2, C.3.

APPENDIX L

DESCRIPTION OF ROCK TYPES

DESCRIPTION OF ROCK TYPES

TEPEE BUTTE FIRE RECOVERY PROJECT
By
Art Kreger, Soil Scientist

The rock types below are commonly found in the Tepee Butte area.

Basalt, Andesite Flows, and Breccia Rocks

This rock type occurs over most of the project area. The age of these formations is early to late Miocene. These rock types that occur are dark gray to black, nonporphyrite andesite; locally-flow breccias, some palagonite tuff and breccia, and minor silicic ash-flow tuffs and interbeds of tuffaceous sedimentary rocks of the Columbia River Group. There are a number of faults within the area, but these formations are fairly stable. Areas of recent mass movement occur in areas of tuffs. Road construction in the tuffs is of particular importance in the toeslope and sideslope positions because of potential cutslope instability, water lenses, and clay seams. These areas are irregular in thickness and extent.

Sedimentary Rocks

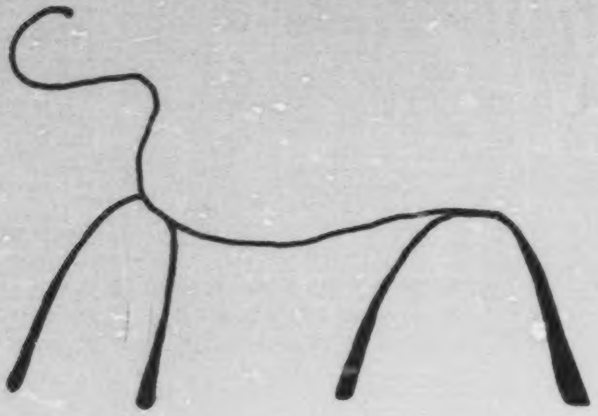
This formation occurs along the Snake River and up Cook and Cherry Creeks. The age of these formations is early to late Jurassic. The rocks are black and gray mudstone, shale, siltstone, graywacke, water-laid tuff, minor interlayers, and lenses of limestone. There are a few faults within this formation. This formation occupies a small area and some instability has been noted along zones of contact between this and other formations.

Intrusive Rocks

This formation occurs along the lower part of Cook Creek. The age of these formations is late Jurassic and Cretaceous. The rocks are biotite, quartz diorite, and granodiorite. There are a few faults within this formation. This formation occupies a small area and some potential instability has been noted along zones of contact between this and other formations. There are indications of some past mass failures in this unit.

Marine Sedimentary Rock

This formation occurs along the lower part of Cook Creek. The age of these formations is late Triassic. The rocks are argillite, mudstone, shale, graywacke, sandy limestone, tuff, chert, and thin-bedded and massive limestone. There are a few faults within this information. This information occupies a small area and some potential instability has been noted along zones of contact between this and other formations. There are indications of some past mass failures in this unit.



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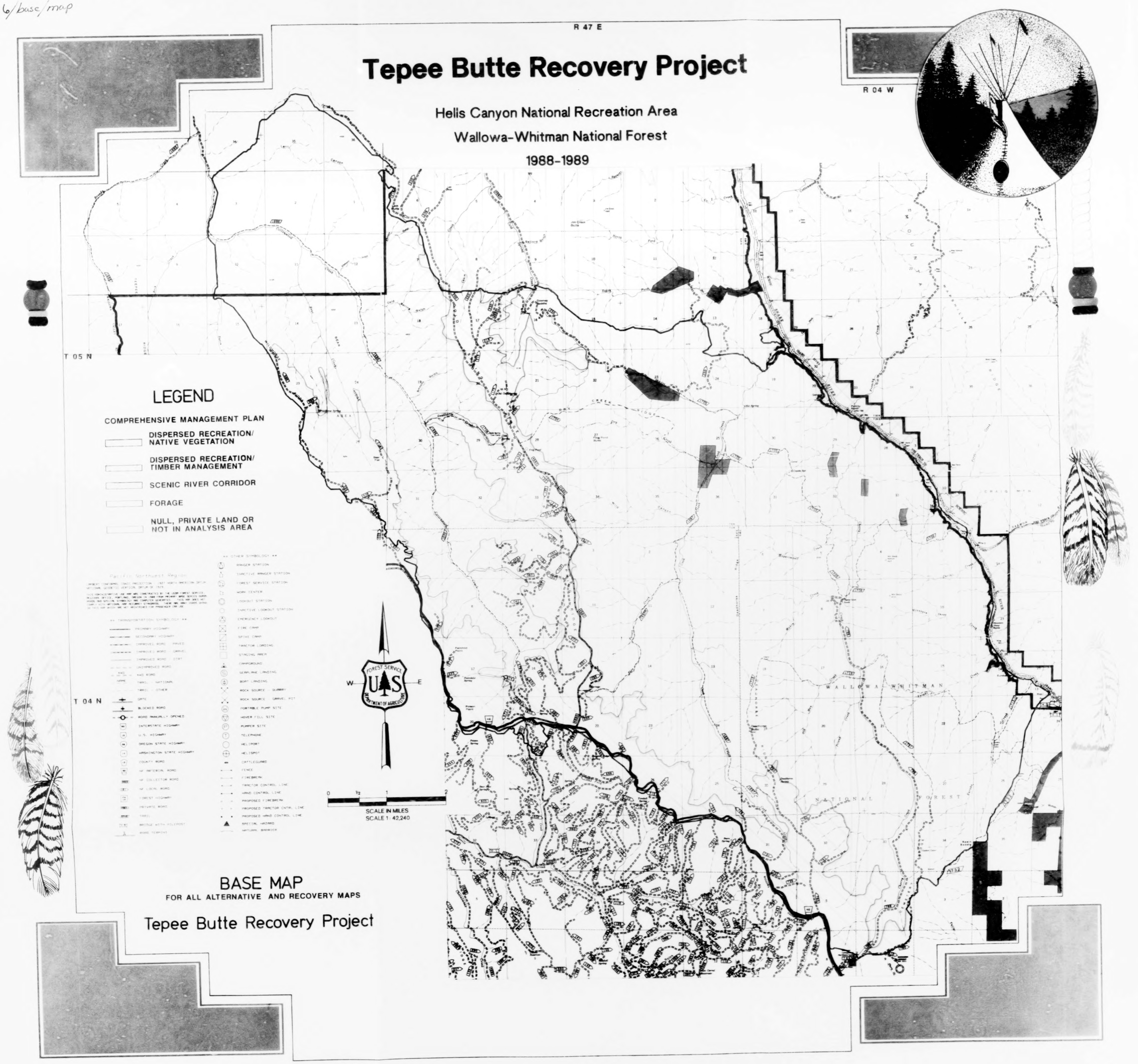

Tepee Butte Recovery Project

Hells Canyon National Recreation Area
Wallowa-Whitman National Forest
1988-1989

LEGEND

COMPREHENSIVE MANAGEMENT PLAN

☐	DISPERSED RECREATION/ NATIVE VEGETATION
☐	DISPERSED RECREATION/ TIMBER MANAGEMENT
☐	SCENIC RIVER CORRIDOR
☐	FORAGE
☐	NULL, PRIVATE LAND OR NOT IN ANALYSIS AREA

Pacific Northwest Region

LAMBERT CONFORMAL CONIC PROJECTION - 1927 NORTH AMERICAN DATUM. NATIONAL GEODETIC VERTICAL DATUM OF 1929.

THIS ADMINISTRATIVE USE MAP WAS CONSTRUCTED BY THE USDA FOREST SERVICE, REGIONAL OFFICE, PORTLAND, OREGON IN 1988 FROM PRIMARY BASE SERIES QUADS. ROADS AND SPECIAL SYMBOLOGY ARE COMPUTER GENERATED. THIS MAP DOES NOT COMPLY WITH NATIONAL MAP ACCURACY STANDARDS. THERE ARE MANY ROADS SHOWN ON THIS MAP WHICH ARE NOT MAINTAINED FOR PASSENGER CAR USE.

** TRANSPORTATION SYMBOLOGY **

PRIMARY HIGHWAY
SECONDARY HIGHWAY
IMPROVED ROAD - PAVED
IMPROVED ROAD - GRAVEL
IMPROVED ROAD - DIRT
UNIMPROVED ROAD
4WD ROAD
TRAIL - NATIONAL
TRAIL - OTHER
GATE
BLOCKED ROAD
ROAD ANNUALLY OPENED
INTERSTATE HIGHWAY
U.S. HIGHWAY
OREGON STATE HIGHWAY
WASHINGTON STATE HIGHWAY
COUNTY ROAD
NF ARTERIAL ROAD
NF COLLECTOR ROAD
NF LOCAL ROAD
FOREST HIGHWAY
PRIVATE ROAD
TRAIL
BRIDGE WITH MILEPOST
ROAD TERMINI

** OTHER SYMBOLOGY **

RANGER STATION
INACTIVE RANGER STATION
FOREST SERVICE STATION
WORK CENTER
LOOKOUT STATION
INACTIVE LOOKOUT STATION
EMERGENCY LOOKOUT
FIRE CAMP
SPIKE CAMP
TRACTOR LOADING
STAGING AREA
CAMPGROUND
SEAPLANE LANDING
BOAT LANDING
ROCK SOURCE - QUARRY
ROCK SOURCE - GRAVEL PIT
PORTABLE PUMP SITE
HOVER FILL SITE
PUMPER SITE
TELEPHONE
HELIPORT
HELISPOT
CATTLEGUARD
FENCE
FIREBREAK
TRACTOR CONTROL LINE
HAND CONTROL LINE
PROPOSED FIREBREAK
PROPOSED TRACTOR CNTRL LINE
PROPOSED HAND CONTROL LINE
SPECIAL HAZARD
NATURAL BARRIER

W E

0 ½ 1 2
SCALE IN MILES
SCALE 1: 42,240

BASE MAP

FOR ALL ALTERNATIVE AND RECOVERY MAPS

Tepee Butte Recovery Project

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